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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

Concerning Space at Western Gas Association Exhibit in St. Louis.

WESTERN GAS ASSOCIATION,
OFFICE OF PRESIDENT, PENNSYLVANIA BLDG., PHILA., PA.,
January 4th, 1904.

The applications for space for the exhibiting of gas machinery, models, appliances, etc., on the part of the trade, and a number of gas companies proposing to exhibit, are coming in so steadily that there is no doubt whatever but that all of the available space will be taken at an early date, and that those who may be late in applying will probably be unable to secure desired space. I would herewith state it is necessary that all those who desire to exhibit as above, take the matter up with me by February 1st next, without fail, as after that date no further applications can be considered, and the available space will then be pro rated to the best advantage among those who have applied.

F. H. SHELTON, President.

[NOTICE.]

Eleventh Annual Meeting, Michigan Gas Association.

MICHIGAN GAS ASSOCIATION,
OFFICE OF THE SECRETARY,
ANN ARBOR, MICH., Jan. 1, 1904.

The Eleventh Annual Meeting of the Michigan Gas Association will be held in Saginaw, Wednesday and Thursday, the 17th and 18th of February, 1904. The headquarters of the Association will be at the Hotel Vincent. The meeting is to be held in the parlors of the Saginaw Club. The following papers will be read:

"A Few Notes on Ammonia," by Mr. F. E. Sheriff, Battle Creek, Mich.

"The Laying of High and Low Pressure River Gas Lines," by Mr. H. C. Morris, Bay City, Mich.

"The Laying of Mains and Services and Recording of Same," by Mr. John Hellen, Grand Rapids, Mich.

"Care of Benches and Results Therefrom," by Mr. Thos. J. Whalen, Jackson, Mich.

"Advertising: As Advantageous to the Gas Business," by Mr. A. P. Ewing, Detroit, Mich.

"A Report of Progress on the Study of Naphthaline," by Mr. Samuel Ball, University of Michigan, Michigan Gas Association Scholarship.

In addition to these papers, the Question Box will be made the feature of one session. Replies to all questions received are now in preparation.

A beefsteak supper will be served the members at the East Saginaw Club, on the evening of February 17th, by the Saginaw Gas Company.

Rates at the Hotel Vincent have been secured as follows:

Room without bath, for one person	$2.50	per day.
" " two persons	5.00	"
Room with bath, for one person	3.00	"
" " two persons	6.00	"

The Bancroft House is an equally good hotel, where similar rates can be obtained. Those desiring good accommodations should write in advance.

LIBRARY OF CONGRESS
SMITHSONIAN DEPOT.

This meeting promises to be the best in the history of the Association, and every member is urged to be present. Members of other Associations, and gas fraternity in general, are cordially invited to meet with us.

H. W. DOUGLAS, Secretary.

[OFFICIAL NOTICE.]

Premiums Offered, Ohio Gas Light Association.

OHIO GAS LIGHT ASSOCIATION,
OFFICE OF SECRETARY, DELAWARE, O.,
January 4, 1904.

It affords me very great pleasure to announce to the gas fraternity that, in connection with the Twentieth Annual Meeting of the Ohio Gas Light Association, which is to be held in Cleveland, March 16th, 17th and 18th, 1904, Mr. John D. McIlhenny, President of the Association, will offer the following premium for the best paper on "The Best Arrangement for Recovering and Utilizing the Waste Heat from Gas Benches."

Abady's "Gas Analyst's Manual."
Byrne's "Highway Construction."
Carpenter's "Heating and Ventilating of Buildings."
Carhart's "High School Physics."
Crooker's "Electric Lighting," 2 Vols. (1, Station; 2, Distribution).
Crafton, "Handbook of Practical Gasfitting."
Groves and Thorpe's "Gas Lighting."
Hughes and Richard's "Gas Works."
Johnson's "Engineering Contracts and Specifications."
Kent's "Mechanical Engineers' Pocketbook."
Patton's "Treatise on Foundations."
"Self-Instruction in Gas Manufacture."
Wagner's "Chemical Technology."
Newbigging's "Handbook for Gas Engineers."

Competition is open to all. A committee will be appointed and announced later to pass on the contributions and the decision of the committee will be made known at the meeting. Those desiring to enter this competition should have their paper in the hands of the Secretary not later than March 1st, 1904.

T. C. JONES, Secretary.

[OFFICIAL NOTICE.]

Novelty Advertising Department, Ohio Gas Light Association.—No. I.

OHIO GAS LIGHT ASSOCIATION,
OFFICE OF SECRETARY, DELAWARE, O.,
December 12, 1903.

The Editor of the Novelty Advertising Department, Mr. B. W. Perkins, of South Bend, Ind., desires to announce that his department is now open for contributions to be presented at the Twentieth Annual Meeting, which will be held in Cleveland, March 16th, 17th and 18th.

This department is one of the most attractive features of the convention Its success, however, depends largely upon the active co-operation of the members. It is, therefore, earnestly hoped that the fraternity will not be backward in sending advertising schemes to Mr. Perkins.

T. C. JONES, Secretary.

[OFFICIAL NOTICE.]

Novelty Advertising Department, Ohio Gas Light Association.—No. II.

OFFICE OF THE EDITOR,
SOUTH BEND, IND., December 30, 1903.

The Executive Committee of the Ohio Gas Light Association has added to the Novelty Advertising Department a "New Business Methods Department," which, with the former, will combine any and all methods for furthering the business of gas companies. This will include any scheme or method that has been, or is being, used to further the sales or use of gas, coke, tar, gas fixtures, fittings, ranges, heaters, etc.; in short, all residuals and gas consuming appliances, whether for fuel or lighting purposes.

Contributions are requested from all, whether they are members of the Ohio Gas Light Association or not, as the proceedings are published and the use of any method mentioned is for the use of the fraternity at large. Contributions are requested to be sent as early as possible, as their arrangement and printing require considerable time.

Yours truly, B. W. PERKINS, Editor.

[OFFICIAL NOTICE.]

Wrinkle Department, Ohio Gas Light Association.

OHIO GAS LIGHT ASSOCIATION,
OFFICE OF THE SECRETARY, DELAWARE, O.,
December 28, 1903.

The Editor of the Wrinkle Department, Mr. E. E. Eysenbach, St. Paul Gas Light Company, St. Paul, Minn., earnestly solicits the co-operation of the fraternity for contributions to be presented at the Twentieth Annual Meeting of the Association, which is to be held at the Hollenden Hotel, Cleveland, March 16th, 17th and 18th, 1904.

Editor Eysenbach will be pleased to receive contributions not later than February 15th.

T. C. JONES, Secretary.

BRIEFLY TOLD.

DEATH OF MR. JOSEPH B. CROCKETT.—Rather incomplete advices by mail from the Pacific Coast, dated San Francisco, the 30th ult., bring us the sad news of the death of Mr. Joseph B. Crockett, ex-President of the San Francisco Gas and Electric Company. He died at the home of his daughter, Mrs. Laurance I. Scott, in San Mateo, Cal., the evening of Thursday, December 24th last, where he proposed spending the Christmas holidays. He had been ill for some time, but it was not thought that the end would come so soon. The funeral services were held in Grace M. E. Church, San Francisco, the morning of December 26th. Deceased was born in St. Louis, Mo., in 1851, and became a resident of San Francisco in 1859, and his first business engagement was with the old City Gas Company. He subsequently became its Engineer. When that Company was merged with the San Francisco Gas Company Mr. Crockett went ahead with its fortunes, eventually becoming its President. This position he retained until the merging of the San Francisco Gas Company with the San Francisco Edison Company, under the title of the San Francisco Gas and Electric Company, of which concern he acted as President until failing health obliged him something like 2 years ago to retire from active business. Mr. Crockett became a member of the American Gas Light Association, October, 1883, and was the 19th President of that body, having directed the proceedings of the 26th annual meeting, held at Niagara Falls, N. Y., October, 1898. He was always a staunch advocate of the aims and purposes of such Associations. He was the moving spirit in the formation of the Pacific Coast Gas Association, and served as its President for two terms —1893 and 1894. He declined a re-election to the Presidency. Later on we hope to give a more complete history of his useful life.

NOTES——

AT the annual meeting of the Lebanon (Pa.) Gas Company the officers elected were: Directors, L. E. Weimer, John W. Mish, H. C. Grittinger, J. P. S. Gobin, Charles Killinger, William Mish and Grant Weidman; President, L. E. Weimer; Secretary and Treasurer, John W. Mish; Superintendent, William H. Merritt.

DURING the last week in December 919 shares of the Gas and Electric Company, of Bergen county, N. J., were sold at public auction, in Hackensack, N. J., at the instance of the executors of the estate of the late Mr. E. E. Poor, of Hackensack. The lot brought $25,500, and the purchasers were Messrs. Eissle & King, of Newark, N. J.

AMENDED articles of incorporation show that the official name of the Waterloo (Ia.) Gas and Electric Company has been changed to that of the Waterloo and Cedar Falls Gas and Electric Company.

THE Directors of the Hartford City (Conn.) Gas Light Company have declared the usual dividend (semi-annual) of 4 per cent. It was made payable the 5th inst. This will be the last dividend declared by the former owners of the property, which is now virtually in the possession of Messrs. Bertron & Storrs, of this city, who are acting for the undertaking Company.

THE Norfolk (Va.) Railway and Light Company has petitioned the local authorities to frame an ordinance under which an official to test gas and electric meters, under suspicion as to their accuracy by either consumers or the Company, shall be appointed and governed.

THE Lowell (Mass.) Gas Light Company has petitioned the Board of Gas and Electric Light Commissioners for the right to increase its capital in the sum of $200,000.

THE New Haven (Conn.) Gas Light Company is also seeking authority to increase its capital in the sum of $1,500,000.

Some High Power Gas Burners.

By Dr. W. H. Birchmore.

Properly speaking the development of the high power burner antedated the introduction of the mantle, and as early as 1845 burners were used in laboratories as efficient as any now found under the mantles; but in these burners there was no limitation as to size, and it was an absolute prerequisite to any usefulness that they should be capable of use through a large range of work, which fact gave to the builders a far more complicated problem than that which has fallen to these inventors of the modern high power burner to solve. The solution which was useful in the laboratory has proved quite useless with the mantle, and the reverse is equally true. Nevertheless the present mantle burner was developed directly from the other forms.

All burners intended for mantle use may be divided into two distinct groups. (A), those which can be used with a by pass; (B), those which require a pilot light. To the first class belong all the burners which are found in the common run of the trade, and they can be so used because at no time is the mixture of gas and air so rich in oxygen as to make the "lighting back" of the burner a certainty when the gas supply is lowered.

It would not be strictly true to say that all the burners which cannot be turned down and used with a by-pass are high duty burners, but it is true to say that no burner can be so used. Definition is also impossible in positive terms, the distinction just given being the description of an accidental quality, not an essential one.

Leaving all theoretical discussion to one side, it is worth while to indicate certain facts which seem to be pregnant with meaning in the history of this development. This the more, because if we follow out the work of various students, we find that a burner form has developed by selection, and, more surprising still, when we come to analyze this form we find that it bears special relationship to the ideal burner which would be developed under certain physical conditions.

In the accompanying drawings are shown sections of burners from my collection, made to scale with the corresponding parts named or indicated by the same letters. The point of most importance is the development of the so-called "waist," the construction of the tube according to one view, the cylindrical connection between the two cones, if another description is followed.

Fig. 1 is a model made about 1890, or may be somewhat later, but not later than 1892, when it came into my hands. Undoubtedly intended for a high power burner it is simply a big Bunsen, and may be "turned down" until the flame is simply a blue line upon the gauze top. When a 10-inch chimney is used with a "Yusea mantle" a very powerful light is obtained. The gas consumption is less than would be expected, and the chief difficulty with it is found in the disposition of the flame to burn outside the mantle, smothering the luminosity and making an uncertain light.

Fig. 2 is a sketch of a burner which is in all things typical of the best modern types. It is no doubt suggested by certain illustrations in books on chemistry, the part marked *A* being the only new detail. The countersunk edge of the burner tube's lip at *B* is worth noting. The tube *B* corresponding to the same portion in Fig. 1 is the same diameter, but the tube of the cap is shortened. This introduces the "waist" *C* for the first time. It is in the wrong place, however, the upper edge coinciding with the middle of the burner. This shortens *D*, and makes the taper of the lower tube more than the taper of the upper tube. The lower air passages are identical and everything goes to show that the man who designed or invented Fig 2 had seen Fig. 1. It is to be noted that in both of these burners the air enters by way of a shutter, also that the gas enters the tube by way of the holes in plate *G*, a group in both cases. Not a group of three, as in a common form of the Welsbach burner, punched in a diaphragm, but a group of five holes, all of them countersunk on both sides with the edges countersunk to give a sharp edge, and the diameter of the middle hole twice that of four outer ones.

This burner is commonly ascribed to a man, Heyse by name, said to have been a workman in the railroad shops at Omaha, Neb. I obtained the burner in Chicago, but do not yet know if it ever was a commercial article; mine was certainly only a model. It is efficient in a way, but not more so than the common burners of the hour. It presents no special advantages.

Fig. 3, which came into my hands in 1898, is much more of a burner. Made by a man named Parker, it presents a number of peculiar points.

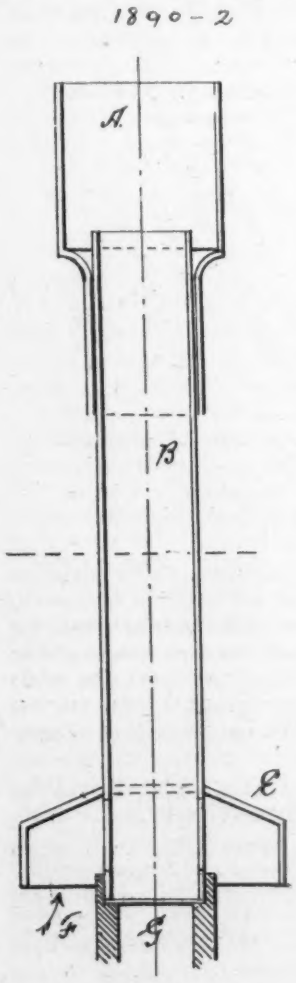


Fig. 1.

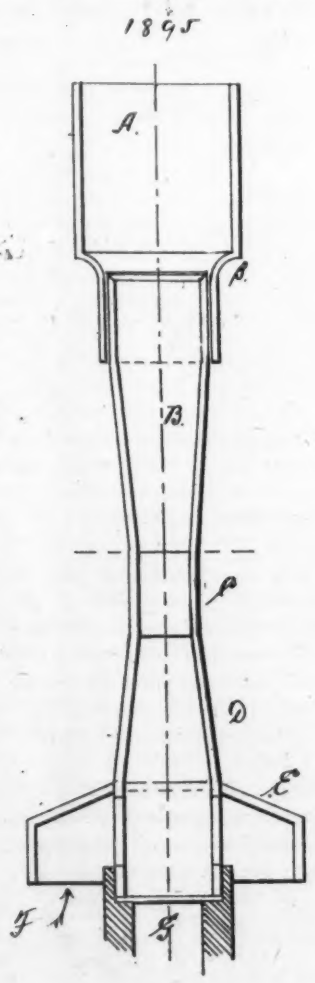


Fig. 2.

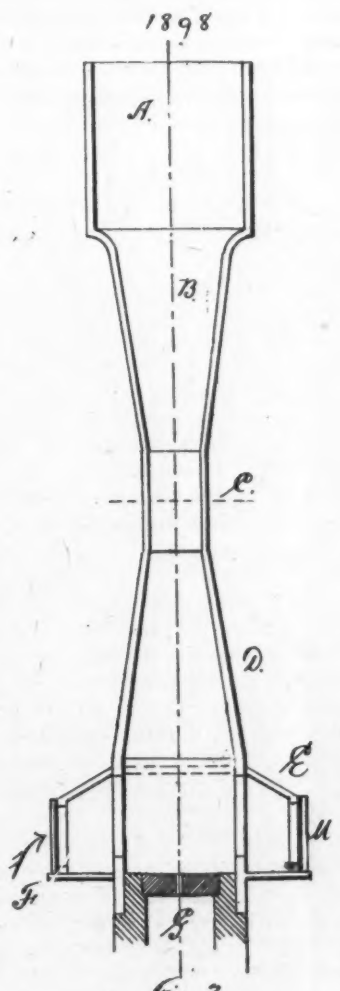


Fig 3

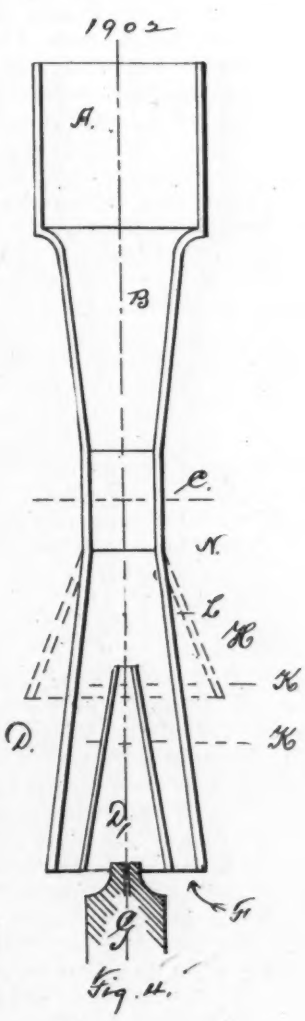


Fig. 4.

The waist *C*, is where it belongs and the two cones are symmetrical. The air supply seems to have been modified from a burner in common use, but is very much better fitted for usefulness.

The use of a single aperture at *G*, in a rather thick plate, is very suggestive indeed. In point of fact it was a step forward, but the footing was not sufficiently firm for the next step. Parker abandoned his work and regarded his burner as a failure, because it would at times detonate and shatter the mantle, the mixture in the upper portion becoming explosive by the admixture of too much air, due probably to the gradually increasing air supply and the cutting down of the gas supply by friction in *G*. By changing the diaphragm *G*, for one with a larger hole, this trouble was easily obviated, and by proper adjustment of the outer ring *M*, so that the apertures *F*, gave a little less than enough air to give a maximum efficiency when the burner was cold, but just enough when the chimney had become heated for any possible demand, this burner was made the peer of any of that date. The abandonment of his so nearly finished task by Parker has always seemed to me a curious case of misunderstanding, for there is no doubt that he had made a burner with an efficiency fully equal to that of most of those now in use. Had he been a man of education or of means sufficient for the prosecution of his experiments his results would have been, I think, equal to any attained, but he was needlessly secretive. Working for a large concern, he seemed to fear that his employers would "steal his ideas," and consequently he worked at home and in secret, having no means to put his invention to the test except in respect to illuminating his own small room. Who Parker really was I never knew. He died unhonored and unsung, but I obtained the paoduct of his genius from a fellow workman who had retained it in memory of his chum, and knowing my interest in such things gave it me, "because!"

Oddly enough, the people for whom Parker worked had first and last made many model burners until, to use the words of one member of the company, they had accumulated a whole barrel of failures, and to this hour they have never, so far as I am able to learn, made the one success for which they have hoped, and for this reason, and this alone, they have been driven back to the acceptance of that which they did not want. The regular commercial Welsbach (this alone seems their refuge) they do not like, because the unit is too large (they say), and the knowledge that his unit was at least twice that of the Welsbach in common use may have been the cause of Parker's discouragement, as he saw no further than the want of his then surrounding. This short-sightedness is the more remarkable, as had he but reduced his dimensions, retaining the principle which he had discovered, or may be had by mathematical work ascertained, he could have made the smaller unit use a smaller mantle (the miniature Kern), and easily have gained his employers' aim, a smaller unit, and have assured to his family an easy future. Is it another instance of the antagonism between employer and employed, as to ideals and purposes—in every way?

In 1902 I picked up Fig. 4 in a junk pile. It was finished, all except *G*, which was intended, I was informed by the man who made it, should be a "regular nipple end." This burner, with its internal cone, is typical of many, and this also would have been successful in the largest way but for the calm disregard of the mathematics in the case. It suffices for this present to say that it has come so near to the correct figures in its dimensions that it is impossible to understand why the changes needful were not made and the faults made virtues.

If *D* be truncate at the line *K*, and the end of the brass cone brought up to *K*, while the walls of the outer cone are given the position *H*, indicated by the dotted lines, the form of burner is identical with the last promulgation of the burner fiends. It is worth noting, however, that while in the original of Fig. 4 the apex of *D* was at *L*, the apex also of *B*, in the modification the apex coincides with *N*, the lower limit of the cylindrical portion or "waist." In this modification the sides of the cone D^1, while parallel to the sides of *B*, are not coincident with them as they are in the burner whose section is shown in Fig. 4. This is an important theoretical difference, and one which will be the cause of no small amount of mathematical investigation if the burner proves its right to stand as a burner of the future. It is a small detail in construction, but mathematically it is a mountain.

It may interest some readers to note the peculiarities in these designs, which are at once so like and so unlike. Thus, it is impossible not to note that in Figs. 2 and 3 the waist has the same size, and yet it is most unlikely that the men who made them were in any way under the influence of each other's work. In Fig. 4 one dimension is the same as in the Fig. 3, but the diameter is a trifle greater. What has produced this coincidence in the work of men who probably never even heard each others' names? Does it not show that working on like problems, bound at two points by, at least in effect fixed conditions, the solution also is fixed or predetermined? Such coincidence in design, coming from attempts organized simply by experience and empiricism of the crudest sort, would indicate that along the line of higher development, made possible by mathematical examination and discussion, should come success, were it not that the men who can make such analyses have no means of meeting in friendly explanation and discussion the men who are able to convert the mathematical data into glass and brass.

The writer knows that in one case a burner design worked out to every detail was placed at the disposal of the manufacturers, was referred by them to a man, who had entered their employ as a boy, a score and a half of years before, and who had no mathematical training whatever. This man decided against the burner at once, setting his disapproval upon the design as "unpractical," giving his reasons for so doing that "He had seen nothing like it before." Later he frankly told the writer, "I could not understand what he was trying to do, and I was not going to let a boy like him think he could teach me, so I told the old man it would cost too much to make and that it was pretty in theory, but would not by any means work." "Turned him down on principle!" "Yes; that't it. If he had come to me first it might have been different; see!"

I saw, but I have been wondering what will happen when that burner is being sold as it will be some day—I think.

If this short note shall arouse a desire in the minds of some of those having the opportunity to study the mathematical demand which must be filled before the construction in brass can be satisfactorily made the purpose in making these notes will be fulfilled.

Prices for Gas Charged in the Named European Cities.

The following table of rates charged for gas in the named foreign cities has been furnished us by a well-known gas man, who recently returned from a sojourn in Europe:

Place.	Per Cubic Meter.		Per 1,000 Cubic Feet.
Paris	20 centimes		$1.12
Thoune	27 "		1.51
Olten	17 "		0.96
Neufchatel	20 "	for light	1.12
	16 "	" heat	0.90
Fribourg	22 "	" light	1.23
	20 "	" heat	1.12
Berne	25 "	" light	1.40
	20 "	" heat	1.12
Milan	27 "	in the city	1.51
	17 "	outside the city	0.95
Biarritz	30 "		1.68
Lourdes	40 "		2.24
Brussels	14 "		0.78
Antwerp	13 "		0 73
Rotterdam	14 "		0.78
Hague	18 "		1.01

A Rapid Metho for the Determination of Sulphur in Coal and Coke.

[Contributed by MESSRS. J. D. PENNOCK and D. A. MORTON to *Jour. Am. Chem. Society.*]

As is well known, foundrymen require coke containing a minimum percentage of sulphur. It has been found necessary to be able to quickly determine the percentage of sulphur in the coal to be used for coke making in order that a selection of those cars containing coal low in sulphur may be made, for the railroad companies charge demurrage on all cars not emptied in 24 hours. By the method described in this paper, one chemist has been able to make 20 determinations of sulphur in 6 hours.

The determination of sulphur in coals and cokes, as described in this paper, is, in its essential features, a combination of parts of two methods already in use. These parts are, first, the process used by Sundstrom[1] for the complete oxidation of coals by means of sodium peroxide; second, the method of Andrews[2] for the volumetric estimation of the sulphur thus formed.

In carrying out these processes, however, various modifications have been introduced in order to accomplish, as perfectly as possible, the end in view; namely, the accurate, rapid and convenient estimation of sul-

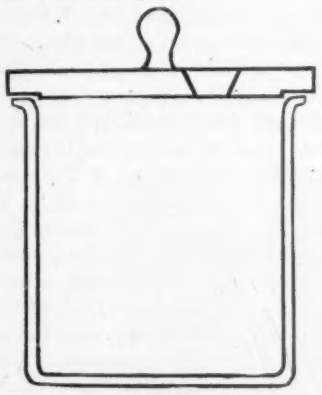
1. *Am. Chem. Jour.*, February, 1903.
2. *Am. Chem. J.*, 11, 567; *J. Anal. Chem.*, 4, 73 (1890).

phur in coals and cokes. This object is satisfactorily accomplished by following the method as outlined below.

Crucible.—A soft steel crucible of about 40 cc. capacity, the lid being perforated with a small hole for the introduction of the igniting wire.

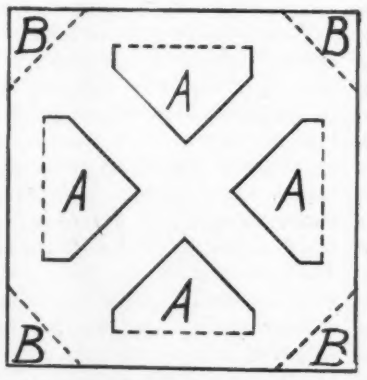
Crucible Stand.—Any arrangement suitable for holding the crucible firmly in place and out of contact with the beaker during the peroxide combustion.

The following diagrams show the form of crucible and stand used in this laboratory:



Crucible.

Thickness of walls and bottom of crucible, 1-32 inch.
Hole in cover, diameter at top, ¼ inch.
Hole in cover, diameter at bottom, 3-32 inch.
Other dimensions as shown in diagram.
The crucible and lid are nickel plated.



Stand.

The stand is made from a sheet of aluminum, 2 inches by 2 inches, cutting as indicated by the heavy lines, then bending upward at right angles the four points marked "A," and downward at right angles the four points marked "B," making the bends along the dotted lines.

Barium Chromate Solution.—A solution of 23 grams pure barium chromate in a mixture of 80 cc. concentrated hydrochloric acid and 920 cc. water. With the use of commercial C. P. barium chromate, much trouble has been experienced because of its impurity. A suitably pure barium chromate may be prepared by adding a dilute potassium chromate solution to the theoretical quantity of barium chloride, also in dilute solution, and then washing the precipitate thoroughly.

Sodium Thiosulphate Solution (tenth-normal).—24.8 grams of the pure crystallized salt dissolved in water and the solution diluted to 1 liter.

Iodine Solution (tenth-normal).—12.69 grams iodine dissolved in a solution of 18 grams potassium iodide in 50 cc. water and the mixture diluted to 1 liter.

Starch Solution.

The Determination.—Introduce into the crucible 16 grams sodium peroxide and 0.7 gram coal (or 11½ grams sodium peroxide and 0.7 gram coke) and mix thoroughly by means of a small spatula. Cover, and place the crucible on its stand in a 20-ounce beaker of water, in such a way that the lower half only is immersed and the base of the crucible is slightly raised from the bottom of the beaker. Ignite the contents by thrusting a red hot wire through the hole in the cover into the mixture. Complete fusion and combustion take place almost instantaneously. After 3 minutes or more, remove the stand and tip the crucible over on its side in the water. The fusion dissolves in a few moments and the crucible is then rinsed and removed. Add hydrochloric acid to the solution until distinctly acid, and boil. To the boiling liquid add ammonia until a few drops in excess, let boil vigorously a minute or two, then add 15 cc. of barium chromate solution and boil another minute. Add sufficient water to the boiling solution to make its volume 200 cc., then ammonia until several drops in excess, and continue boiling vigorously for 1 or 2 minutes longer. Allow to settle a few moments, filter and wash the precipitate twice thoroughly, using from 20 cc. to 30 cc. of hot water for each washing.

Add about 1 gram potassium iodide crystals to the filtrate, cool to 30° C., add 5 cc. hydrochloric acid, then run in the thiosulphate solution until the end point is reached. The presence of a few cubic centimeters of starch solution renders the end point more distinct. Titrate back, if necessary, with the iodine solution.

$$\text{cc. N/10 } Na_2S_2O_3 \times 0.153 = \text{per cent. S.}$$

The determination depends, of course, on the fact that the precipitation of barium sulphate liberates an equivalent amount of chromic acid, which remains in solution as ammonium chromate when the excess of barium chromate is precipitated by ammonia.

Remarks.—The directions for the peroxide combustion should be followed with especial care, for, if less sodium peroxide is used than the directions require, the reaction may be explosively violent; and, on the other hand, if too much sodium peroxide is used, the combustion will be incomplete. Also, the thorough mixing of the fuel with the peroxide must not be neglected or an explosive and incomplete reaction will result.

After each addition of ammonia, the solution is boiled to remove most of the excess, but it should still remain slightly ammoniacal. The addition of the barium chromate does not always precipitate the sulphate immediately, but the subsequent boiling for 1 or 2 minutes insures complete precipitation. The final washing of the precipitates, if carried too far, will dissolve precipitated chromate and thus introduce an error. It has been found that two washings, using a small amount of hot water for each, produces the desired effect of thoroughly removing the chromate in solution without decomposing the precipitate.

Results.—Up to the present time more than 1,000 determinations by this method have been made in this laboratory. The accuracy of the results has been tested by comparison with the Sundstrom method, with the Eschka method, and by tests on solutions of known sulphate content. A number of the results thus obtained are cited below. The determinations on coal sample No. I were made independently by three analysts, each making two tests by the volumetric and two by the Eschka method. The four volumetric determinations of coke sample No. I required exactly 1 hour's time, showing the extreme rapidity as well as the accuracy of the method.

	Soft Coal Samples.				Coke Samples.		
	I.	II.	III.	IV.	I.		II.
Per cent. S, volumetric method.	1.95 2.03 1.97 1.98 2.01 2.04	1.26 1.26 1.30	1.16 1.16	1.06 1.06 1.02	0.71 0.70 0.70 0.75		1.43 1.41
Per cent. S, Eschka method.	2.03 2.06 2.04 2.06 2.04 2.00	1.30	1.20	1.05 1.07	0.75 0.68 0.70 0.70	Per cent. S, Sundstrom method.	1.47 1.42

Solutions, each containing 23 grams sodium chloride, a little iron, and a known quantity of sulphate (hence practically of the same composition as the solution obtained by the peroxide fusion of a coal) gave the following results:

Per cent. S present..	0.46	0.914	1.37	2.29	0.98	1.96
Per cent. S found...	0.45	0.91 0.90 0.92	1.35	2.33 2.36	0.96 1.02 0.99 0.99	1.93

Conclusion.—The results of all tests show that the method carried out in accordance with the above directions is accurate to within a few hundredths of a per cent., and is so rapid that an average of 2 or even 3 complete determinations per hour can be accomplished. It can be used with especial advantage where large numbers of sulphur determinations are required, since in such a case its saving in time and in the use of platinum becomes an important item.

The method can be successfully employed not only for the determination of sulphur in coals, but also, with suitable modifications, for the determination of small percentages of sulphur in a large number of organic and inorganic substances.

Gas in New Orleans.

Last spring (April, 1903) we noted that Mr. Thomas D. Miller, General Manager of the New Orleans Lighting Company, delivered a lecture, before the Louisiana Engineering Society, on the subject of "Gas," before a large and interested audience. Since then the lecture has been printed in the *Journal of the Association of Engineering Societies*, from which *Journal* we reproduce the following points in the lecture relating to the history of gas supply in New Orleans:

In 1829, on the 7th day of February, the Legislature of the State of Louisiana passed an act incorporating a company under the title of the New Orleans Gas Light Company. This franchise was declared forfeited in 1833, and the exclusive privilege of vending gas lights in the city was given to James H. Caldwell, of New Orleans. In 1835, by an act of the Legislature, Mr. Caldwell transferred his privileges to the New Orleans Gas Light and Banking Company. The banking rights of the Company were later reliuquished. In 1881 an opposition Company was projected, and, as a result of 4 years' litigation, the Supreme Court of the United States, in 1885, confirmed the exclusive rights of the present Company, as granted by its charter, to make and vend gas lights until April 1, 1925.

One of the provisions of the grant was that the price of gas should never be raised above $6 per 1,000 cubic feet. In 1854 there was another amendment to the charter, which provided that the price of gas should not be above $4.50 per 1,000 cubic feet.

The first plant was erected in 1836, and consisted of 3 benches, of 3 iron retorts each, on the corner of Gravier and Locust streets (now known as Robertson street). The plant was enlarged in 1850 or 1852 to 16 benches of 3 iron retorts each.

In 1859 the building that is now used as a generator room was erected, and in it were installed 40 benches of 3 clay retorts each, each retort being 12 by 20 inches and 8 feet 16 inches long. The hydraulic main was circular in section, 18 inches in diameter, and the benches were supplied with 4-inch standpipes. About 1868 there were placed in these benches 5 retorts, space for them being created by lowering the floor line of the retort house and setting the furnace lower down. The same hydraulic mains were adapted to this change.

These benches were used until the consumption had reached 1,100,000 cubic feet per day, and about 1875, the retort house, on the corner of Perdido and Magnolia streets, was built, and in it was installed 48 benches of 6 retorts each. These benches made all the gas until about 1883, when the Egerton process for making gas was put in.

This process consists of a set of generators for producing water gas and an evaporator for vaporizing naphtha. The naphtha vapor was taken up by the water gas and carried along through heated retorts as fixing chambers. This was the time the "dollar-and-cent meter" was put into use in New Orleans, and 33 candle-gas was made. Many of these dollar-and-cent meters are still in use in the city. The rate on these meters is $3.70 per 1,000, and, in order to reduce the registration of the dollar-and-cent meter to cubic feet, it should be divided by 3.7. This, or a similar water gas process, was used until 1895, when a standard Lowe water gas plant was installed and has since been in continuous operation.

I have already referred to the mechanical accountant—the station meter. All of the gas made is measured by this station meter, and, at the close of a month's business, all gas registered by the consumers' meters is totaled up, and the difference between the amount made and the amount sold is ascertained. This amount will vary in different plants, and is largely dependent upon a variety of conditions, viz.: The temperature at which the gas is measured in the station meter, the tightness of the mains and the correctness of the consumers' meters.

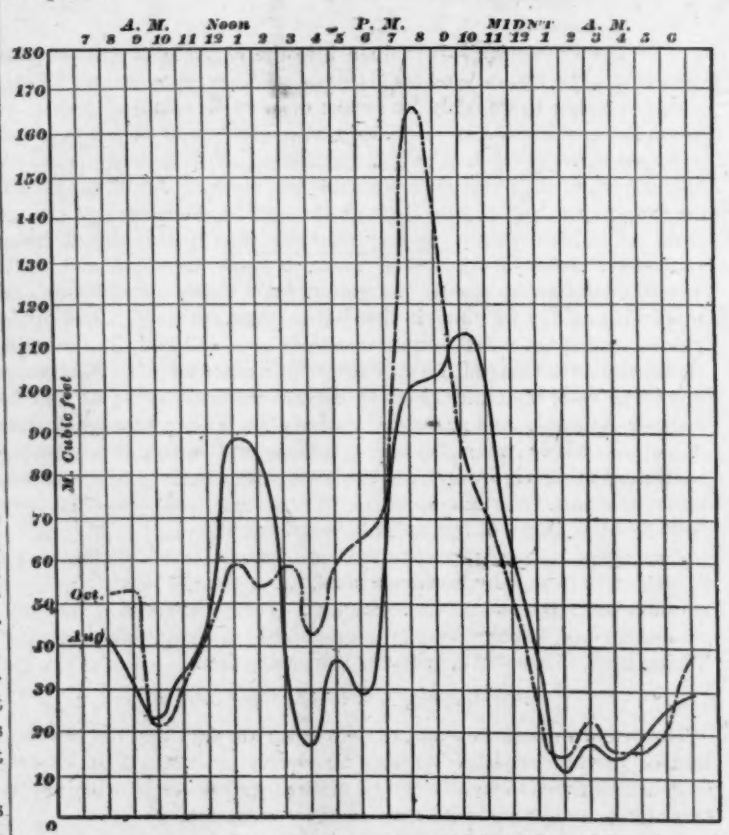
To overcome the question of temperature the quantity of gas measured by the meter is corrected to a uniform temperature, say 60° or 70°, according to the climate in which the business is being conducted. Notwithstanding this fact, it is never found, at the end of the year, that all of the gas sent out into the mains has been sold, and, if the loss is no greater than 8 per cent., it is concluded that mains and meters are in excellent condition; but cases are on record where the loss has been as great as 25 per cent., and even a few instances where it has reached 50 per cent., in the early days when wooden mains were considered the very thing.

In New Orleans the question of leakage has not been very serious, because of the presence of water in the ground at practically all times of the year. We have little trouble over the loss of gas from its getting out of the mains, because where there is a leak in the main there is water enough present in the ground, with sufficient pressure to prevent the gas from leaking out; instead, the water leaks in, and, as a result, we have a large expense account for pumping water out of the mains. If the ground became well drained and the usual conditions of elevated land existed, no doubt our leakage account would be as large as other well regulated plants. This seepage of water into the mains gradually causes the formation of a deposit, which finally has to be removed. This process of washing out the gas mains is, I believe, peculiar to New Orleans. The mains are flushed in this manner. The main and branches of 2 or 3 blocks are cut and plugged, and a hose is attached from a fire hydrant to the main; the main is filled with water under pressure, and the plug at the far end is knocked out and the water allowed to gush through, after which it is washed for 18 or 20 minutes, and thereby the mass of sediment at the bottom of the mains is removed. This accumulation has become so great in some instances that it has retarded the flow of gas during the early hours of the evenings to such an extent that certain sections have been entirely without gas.

In the distribution of gas from the holders, all of the pressure of gas in the mains is given by the weight of the holder. In order to maintain uniform pressure and not to have a pressure on the mains higher than is necessary to give a good service, governors of the pressure are used at the works. These are operated in a manner to produce a pressure according to the demand on the mains, but in the rapid development of the gas business recently experienced in New Orleans, the demand on the mains was far greater than the supply of gas that could be forced through them with the weight of the holders, and even had they been heavy enough, it would have been undesirable, because the pressure would have been excessive to the extreme in the pipes leading out from the works, and would have gradually diminished until out or near the extreme limits of the system, and the proper pressure would not be obtained. In order to overcome this difficulty promptly, and at a reasonable cost, a high pressure system of distribution was introduced in New Orleans, and has been in operation for about a year past. This system consists in compressing the gas to from 15 to 35 pounds, and sending it out to the outlying districts in small wrought iron mains, laid expressly for the purpose, to a desired point where the gas is fed into the low pressure mains and the pressure is reduced through a regulator to the proper amount to be maintained in the low pressure mains. At the present time there are 4 such stations in the city. The entire gas supply of Algiers is furnished through a high pressure pipe, which is laid on the bed of the Mississippi river, and the low pressure distribution pipes in Algiers are supplied with gas through a small governor station on the Algiers side of the river. So far, this method of distribution of gas has proved eminently satisfactory, and the gas supply of Algiers has been interrupted on but two occasions in the 6 months since it was turned on. This was necessitated by the breaking of a fitting in the high pressure piping at the governor station in Algiers, and the change of fittings was accomplished in less than an hour. The other shut-off was occasioned by the necessity of lowering the main on this side of the river at the head of Julia street, and, in order to keep the supply of gas on while this lowering process was going on, a heavy 2-inch steam hose was inserted in the pipe in order to give a flexible connection to permit the pipe to descend, keeping the gas on all the time. This 2-inch rubber hose is still doing business in the turbid flood that has been rushing by for several weeks past, but no interruption to the supply has occurred.

The old Valence Street Works, formerly the Jefferson City Works, have long since been abandoned for manufacturing, and only the storage holders at this plant are in use. The holders are filled daily from the high pressure main which was carried there for that purpose.

The hourly consumption of gas is subject to quite a large variation during the 24 hours, and there is a distinct peak of load as in the electric consumption for electric light. The accompanying diagram shows this peak.



Curve Showing Hourly Output for One Day Each in October and August.

The history of the gas business in New Orleans is almost the history of the gas business in the United States. It was the second gas works

built in this country. To-day the gas of New Orleans is made with the most modern apparatus known, and if it is safe to predict from the past, New Orleans will be one of the first to avail itself of any material improvements which may be made in the manufacture of gas.

Binks's Whitewashing and Painting Machine.

The Binks whitewashing and painting machine, the invention of Mr. C. F. Binks, of Chicago, is finding as much favor abroad as it enjoys in this country. The illustrations given show the apparatus, which is designed for applying whitewash or oil paint to walls and such like surfaces in a much more expeditious manner than the ordinary process of laying on with a brush by hand. Fig. 1 is a perspective view of the

Fig. 1.

machine as it would appear in operation, and Fig. 2 is a vertical section

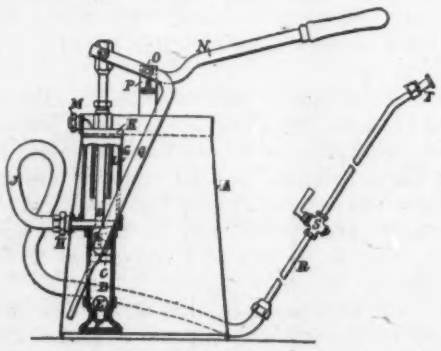


Fig. 2.

through the center. The machine works by means of compressed air, which blows the limewash, paint, etc., in the form of spray on to the surface to be covered. Its action will be more readily understood on reference to Fig. 2. In this view *A* is a circular vessel, which contains the whitewash or paint; *B* is a pump barrel in which a plunger *C* works. The plunger and its valve are carried by a rod *D*, which at its upper end is connected to the short arm of the lever *N*, which is supported at the point *O* by a pin. The bridgepiece *P*, which reaches across the top of the containing vessel, carries this pin. There is also a right angled lever *Q*, which rocks on the pin *O*, the short arm of which is connected to the top of the piston rod. While the long arm moves to and fro in the vessel *A*, it acts as a paddle or stirrer for any liquid contained therein. At the bottom of the pump cylinder *B* is a ball valve *E*, and below that a strainer *F*.

The action of the machine is as follows: The vessel *A* having been filled with the material to be used, the lever *N* is worked up and down, which action draws the liquid through the valve *E* into the cylinder *B*, and then forces it up through the valve in the plunger *C*, as in an ordinary pump. If the cock *S* on the pipe *R* is closed, the liquid is forced into the upper part of the pump *B*, where it compresses the air in the space *L*, inside the air vessel *G*. One man working the lever *N* is able to compress the air to about 120 pounds per square inch. If now the cock *S* be opened, the air in the receiver forces the liquid below it through the pipe *R* and out at the nozzle *T*, where it is blown into fine spray, and in that state can be deposited on any surface, as desired. There is a pipe at the top of the air vessel, which is closed by the plug *M*. Should the air contained in the space *L* leak out at any time, the plug *M* can be removed, and a fresh supply of air be admitted into the vessel *G*. The hose pipe can be disconnected by unscrewing the union nut *H*.

The machine is made in several different sizes, and can be had, if desired, mounted on a trolley and supplied with a 100 feet of discharge hose pipe. One, of the size illustrated, which stands about 18 inches from the ground to the top of the container, is said to do the work of 8 men with brushes, while the larger size machines will do as much work as 20 to 25 men. It will readily be understood, therefore, that their use is likely to effect a great saving of labor in the frequent limewashings required in buildings used for manufacturing purposes.

The Sheet Metal Trade.

The *Metal Worker* reports that so far as the sheet metal trade of the country is concerned, the year just closed consisted of two periods of distinctly different conditions. In the earlier part of the year the demand for sheet metals of all kinds was unusually active. This activity culminated at midsummer, at which time practically all the sheet and tin plate capacity of the country was in full operation. The troubles in the building industry which developed at that time soon made their influence felt upon this trade, and later in the year business fell off very materially. At the close it was absolutely flat, with more than 50 per cent. of the sheet and tin plate mills lying idle for lack of orders. Had not the setback to the building industry occurred, there was every indication that 1903 would have been a banner year in the sheet metal trade. In view of the marked activity in the first part of the year, however, it is probable that the total volume of trade in this department for the 12 months will not compare very uufavorably with that of average years in the past, while prices were, if anything, more satisfactory, at least before the reductions which came with the falling off in business in the last few months.

The most notable event of the year in the sheet and tin plate trade occurred at its close, in the consolidation of the American Sheet Steel Company with the American Tin Plate Company, under the title of the American Sheet and Tin Plate Company. This merger had been expected for some time past. The two subsidiary Companies of the United States Steel Corporation were run on largely parallel lines, and their amalgamation was a natural development. The advantage to the Steel Corporation of having these two interests under one management will be great, insuring a material saving in operating expenses and the cost of administration, The consolidation places the sheet and tin plate plants affiliated with the Steel Corporation in a still more advantageous position to meet the competition of the independent manufacturers in these lines.

The opening of 1903 found the sheet market in a fairly strong position, although a number of the mills were closed for lack of orders. As the early weeks of the year passed, however, the demand for sheets expanded materially until, in the early spring, it was of sufficient volume to give all of the mills of the country full work. Prices, however, were somewhat unsettled, owing to concessions in prices made by the independent concerns to secure business. This tendency was particularly marked in the late summer, when the demand for sheets fell off sharply, owing to the suspension of building operations in many parts of the country. Nearly all of the sheet mills, however, continued to run full until the late summer, the only obstacle to their operation being a scarcity of sheet bars which developed at that period. This scarcity particularly affected the independent sheet makers, who, in the month of September, held a meeting in Pittsburg to consider concerted measures for improving their status. As a result of this meeting the Independent

Sheet Manufacturers' Association was organized. This body includes all the independent sheet manufacturers of the country whose plants are run on a union basis. Most of the sheet mills continued steadily working until the early fall, filling contracts previously placed, and anticipating the stimulated demand for sheets which usually develops in the fall. Owing to labor troubles and other causes, however, this demand did not reach the normal proportions, large buyers refusing to contract ahead in view of the unsettled conditions in financial and labor circles. About this period the American Sheet Steel Company closed down such of their mills as were operated on a union basis and made arrangements to continue their non-union mills, which form about 60 per cent. of their total capacity, under a reduction in wages, coupled with unrestricted output. Finding that they could not compete under these conditions with the largest producer, the independent manufacturers, whose mills were run under the wage scale of the Amalgamated Association, demanded from the Association the removal of the limit of output and a reduction in the wage scale, in order to enable them to compete with the non-union plants. This demand was acceded to, as the result of a special convention of the Amalgamated Association, held in November, and, although at the close of the year practically all the independent sheet mills were idle, it is expected that the majority of them will start up again at an early date. The price of both black and galvanized sheets underwent a slight reduction during the year, following the decline in the price of steel. It is said that the prices ruling at the present time permit but a slight margin of profit to the makers, even under the favorable conditions in which the leading manufacturers are now able to operate their plants. It would seem, therefore, that the position of the independent manufacturers is by no means as satisfactory as they could wish, particularly in view of the conceded fact that the sheet producing capacity of the country is greatly in excess of the consumptive capacity, even at its highest.

The course of the tin plate market during the year was generally similar to that of the sheet trade, as above outlined, except that the change from intense activity to dullness came upon the tin plate trade more suddenly than upon the sheet trade. At the opening of the year the demand for tin plates was sufficiently large to keep almost the entire mill capacity busy, and the demand increased steadily as the year progressed. The consumption of tin plates was enormous in the early part of the year, exceeding the facilities of the mills. A pronounced scarcity of coke plates developed and spot shipments commanded a sharp premium over the advanced prices made by the American Tin Plate Company in the spring. This condition of things caused all the tin plate mills to run full throughout the summer, for the first time in the history of the tin plate industry. A scarcity of steel hampered operations to a considerable extent in the months of June and July, but this scarcity passed away before August set in. In the course of that month the demand for tin plates fell off, although the mills continued in full operation well into the fall, in order to catch up with contracts on their books. A reduction in November brought values again to the level prevailing a year ago. A marked feature of the tin plate market in the past year was the revival of popularity of terne plates for roofing. The demand for this form of roofing fell off some years ago, but within the past two years the meritorious qualities of tin roofing have again appealed to the public, who in the meanwhile have been trying a number of forms of prepared and patent roofings, with, in many cases, indifferent results. The demand last year ran most heavily to the higher grades of terne plates. The revived use of charcoal iron roofing plates, which are now being made in considerable numbers in the United States, is also notable in this connection.

The export trade in tin plates, while still of comparatively small proportions, shows a gain. The American Tin Plate Company have stated that they are steadily increasing their business in tin plates which go abroad in the form of packages, a trade which formerly went to the foreign manufacturers under the rebate clause of the tariff.

Manufacturers of sheet metal ceilings and interior decorative sheet metal work report a large increase in the demand for their products during the past year. The many advantages of sheet metal for interior use—its lasting qualities and the ease with which it can be stamped and formed into artistic and pleasing decorative effects, and, above all, its fireproof quality—are appealing more widely to the public. At first, sheet metal ceilings and side walls were applied only to the interiors of halls, churches and large rooms; but the manufacturers in this line have of late produced designs suitable for use in the smallest rooms, and the material is rapidly being adopted in dwellings of all classes. The list of concerns who make a specialty of this class of work has increased considerably, and those who were among the pioneers have added to their facilities in order to keep pace with the growing demand for this class of goods. The manufacturers of metal ceilings are paying close attention to the artistic requirements of the public. The designs recently produced are generally of a high order of merit. A substantial export business has grown up in architectural sheet metal work which promises to develop into quite an important business, as foreigners recognize the utility of this material, especially in climates where the ordinary building materials are apt to deteriorate more rapidly than in temperate climates. This applies not only to metal ceilings and side walls, but also to galvanized iron roofing and siding, which have gone abroad of late in considerable volume.

Manufacturers of sheet metal working machinery have kept pace with the progress of the time in all mechanical lines, and have introduced a number of new machines and tools during the year. The volume of trade in this branch was well up to the average, and in some directions in excess of it. Sheet metal working tools have been sent abroad in considerable numbers during the past few months, foreign manufacturers recognizing the superiority of American products in these lines.

The strikes which demoralized the building trades during the summer resulted in a sharp restriction in the demand for sheet metals of all kinds, and in some of the larger centers roofing and cornice and general sheet metal working shops were more or less idle throughout half of the year. The labor disputes, however, have been nearly all adjusted, and the outlook for activity in the building trades, commencing with the spring months, seems brighter than it was a few weeks ago. There is an immense amount of projected building, which must be taken in hand in order to meet the actual housing and the commercial needs of many of the great centers of population.

Recent Developments in the Construction and Working of Gas Engines.

[A paper read by Prof. D. S. Capper, at the last meeting of the English Junior Institution of Engineers.]

The gas engine as a successful machine is the product of the latter half of the century which has just closed; and although the steam engine, with a century's start, still holds the field, and has even burst into fresh vigor with the turbine and the use of more highly superheated steam, it has already been considerably surpassed in thermal efficiency by its younger rival; and there are not wanting signs that in practical convenience and general applicability it may ere long also yield the palm to the internal combustion engine.

To properly understand the steps which have more recently been made in the development of the gas engine, it will be necessary to briefly refer to the more important points in its earlier history.

The earliest commercially successful gas engine was the Lenoir, of 1860, in which a mixture of gas and air was drawn into a cylinder and fired at about half stroke, and then expanded, exhaust taking place on the return stroke. This was a double acting engine, an explosion taking place each side of the piston every revolution, and the quiet running and steadiness of a steam engine were retained with its other characteristics. Ignition was electric. The cost of running was, however, great, as it required about 100 cubic feet of coal gas per indicated horse power per hour.

In the Paris Exhibition of 1867 its successor—the Otto and Langen engine—first appeared. It was a mechanically perfected improvement of an earlier engine invented by two Italians, named Barsanti and Matteucci, and was so arranged that an explosion drove out a free piston like a projectile, which in its upward flight produced a vacuum, against which atmospheric pressure did work on the return stroke. The clutch applied to this engine was probably the earliest, and certainly one of the most beautiful examples of a free wheel. In this engine the gas consumption was less than half that of the Lenoir engine, but the economy was obtained at the expense of practical convenience, the engine being noisy, irregular, and uncertain in action.

It was then that Dr. Otto re-invented and developed mechanically the earlier suggestion of Beau de Rochas, that the systematic and controlled compression of the mixed gases before ignition could alone insure satisfactory and economical working.

From that date—1876—to the present time the well-known Otto cycle has held the field against all competitors, and it is only now that there seems any probability of its pre-eminence being successfully challenged. The cycle, as is well known, consists of:

1. An outward suction stroke.
2. A return compression stroke.
3. An explosion at constant volume and partially a constant pressure and subsequent expansion.

4. An exhaust stroke—four strokes in all per explosion.

The practical disadvantages of such a cycle as compared with that of the steam engine are manifest. Some of these are:

1. It involves an engine considerably larger for the same power.
2. The velocity of the crank varies within much wider limits, as the explosive stroke is followed by 3 strokes in which negative work is done.
3. The noise and the strain on the working parts are much more considerable than is the case with a steam engine.

Thermodynamically, the much greater temperature range gives a large theoretical advantage to the gas engine; but, on the other hand, it has only recently been found possible to practically approach the ideal Carnot cycle nearly as closely as the steam engine does, and the very elevation of the maximum temperature which is theoretically so beneficial makes lubrication of the working parts impossible without artificially cooling them, and thus deliberately throwing away a very considerable portion—30 to 40 per cent.—of the heat supplied.

The improvements and developments which have taken place in the gas engine in recent years may be said to be of two kinds: First, gradual and steady progress has been made in improving and rendering more efficient the Otto cycle; second, attempts, hitherto only partially successful, have been made to replace the Otto cycle by others which will give more uniformity of crank effort—greater efficiency and easier regulation. Outside either of these lines of development there has been advance in the cheapening of the fuel used—cheaper gas and gas more directly suitable for heat production being employed. Successful attempts have also been made to utilize the valuable carbonic oxide gas which has hitherto been going to waste from the blast furnaces, whereas it might supply thousands of horse power continuously night and day if only it were burnt in a gas engine. It will be impossible within the limits of a paper such as this to do more than touch upon some of the examples of the more important developments in these several directions. Taking first the development of the Otto engine. Messrs. Crossley have made rapid and great improvements in its construction and working. The original slide valve has been replaced by mushroom exhaust and air and inlet valves, and by the incandescent tube igniter. Small engines are sometimes still fitted with metal tubes—larger sizes with special porcelain tubes in duplicate, so that liability to breakdown by the bursting of a tube may be said to be eliminated. These changes have rendered possible increased compression and explosion pressures and larger port areas. The 30 pounds per square inch compression pressure of the earlier engines has given place to the 100 pounds or 120 pounds compression pressures of the later types. When using rich lighting gas, this involves very high explosion pressure, and special construction has had to be adopted to prevent destruction of the cylinder ends and (to relieve the pressure on the exhaust valve, which may be 40 pounds or 50 pounds per square inch at release) compensated valves are used. Higher compression involves reduced compression volume, and the ports and clearance volumes have therefore to be reduced to a minimum. This makes it possible to reduce the area of cooling surface in contact with the hot gases at explosion, but nevertheless the temperatures are so high (3,000° to 3,500° F.) that exhaust valves and pistons, as well as cylinder barrels, have to be water cooled.

Thermodynamically, the raising of the compression pressure makes the compression correspond more closely to the adiabatic return from lowest to highest temperature of the Carnot cycle, but the isothermal stage of the Carnot cycle has to be omitted almost entirely. Moreover, with a rich gaseous mixture the compression cannot be carried as high as desirable from the theoretical point of view, as the critical ignition pressure and temperature for the mixture would be reached, and preignition would automatically take place.

The successive increases in compression pressure, accompanied by other improvements, have resulted in the consumption of coal gas per brake horse power in the Crossley engine being reduced from 25 cubic feet by successive stages to 17, 15 and 13.5 cubic feet per brake horse power per hour, which means, with gas of calorific value equal to 680 foot pounds per cubic foot, a thermal efficiency on the effective work of 27.6 per cent. With gas from a producer or blast furnace the consumption would be greater in proportion to the quality of the gas. To overcome or to reduce the inequality of the crank effort, inseparable from the Otto cycle, heavier flywheels have been fitted to the smaller sizes of engines. In the larger sizes the engines are built with two cylinders, one on each side of the crankshaft, both connecting rods working upon the same crank. In this way an explosion every revolution can be obtained. Engines up to 500 to 600 indicated horse power have been built on this principle. Another type adopted by Messrs. Crossley, for engines of large power, is the inverted cylinder vertical type, with the cylinders placed side by side at an angle to one another and to the vertical, so as to resemble very closely the diagonal Thornycroft steam engine. This gives a very well-balanced engine. For very large powers 4 cylinders can be used, so as to obtain an impulse every stroke. The governing of the engine may be made very greatly to assist the regularity of running, and in recent types an automatically regulating governor has been fitted, in which a perforated sleeve slides inside the admission valve under the control of the governor. The sleeve is driven by an eccentric through a rocking lever, with fulcrum adjusted through a right-handed and left-handed thread by the governor. By this means, without the necessity for a very powerful governor, recent experiments have shown that in the latest types of Crossley engine, between full load and no load, the speed can be kept constant to about 1 per cent Electric ignition is only used by Messrs. Crossley where the conditions prevent a suitabje jet for tube ignition being fitted. When electric ignition must be used, they prefer an electric igniter fitted with a permanent magnet. When the Crossley engine is used for electric lighting purposes, the dynamo can either be coupled direct to the crankshaft or built upon the flywheel, so as to reduce the space occupied to its smallest dimensions.

The gas engines manufactured by the British Westinghouse Company also work upon the Otto cycle. These engines are of the vertical type, and are built both single and double acting. Single acting engines are made either with 2 or 3 cylinders side by side. In the 2-cylinder type there is one impulse every revolution, and with the 3-cylinder type an impulse every two-thirds of a revolution. The crank effort is, therefore, very uniform, and the floor space occupied not large. The engines for electrical generating purposes are direct coupled to the dynamos. In the double acting type the cylinders are generally arranged one each side of the dynamos. The engines are built on the inclosed model, the cranks and connecting rods being inclosed in a casing which forms the framework of the engine and contains an oil bath.

Gas and air are admitted into the mixing chambers through separate regulating valves, and thence pass through a mushroom controlling valve into the cylinder. With very small clearance volume the compression is high. Ignition is electric and the igniter is arranged as a movable plug carrying the necessary terminals. All valves are arranged so as to be readily accessible and removable for inspection. The governor regulates the quantity of explosive mixture, the proportion of air to gas remaining constant under all conditions of load. The centrifugal governor actuates the spindle of the admission valve and controls the charge. The admission valve can be set to give any required proportion of air to gas to suit varying qualities of gas. The engine is started automatically by compressed air. A reservoir is filled with compressed air on the previous run of the engine, or it may be charged separately. At starting, this compressed air is admitted to one cylinder, which it drives round until firing has taken place in the other cylinders. The engines may be also driven by petrol or gasoline; but in this case the fuel must be gasified in a specially provided gasifier, and a charge of gasified oil and air is thence sucked into the cylinder. In the largest sizes the cylinders, exhaust valves and pistons are all water-cooled. In the double acting engines the two cylinders are generally set with cranks at 180°, an impulse taking place at every stroke. The valve gear is driven through worm gear on the main engine shaft and a horizontal cam shaft fixed on the outside of the casing, a vertical spindle transmitting the power from the worm on the main shaft to the cam shaft. The cranks in both types of engine are of the disk overhung type, fitted with balance weights. The main bearings are in many cases lubricated by forced lubrication.

With the introduction of producer gas, and the use of blast furnace gas, both of which are of poorer quality than coal gas, and, therefore, require cylinders of larger diameter, engines of much higher power are being constructed by a number of firms.

Restricting ourselves for the moment to those engines which work on the Otto cycle, the following will furnish some of the more important examples of large engines at present in use. The Premier Gas Engine Company, Limited, of Sandiacre, have specially developed this type of construction, and engines of 500-brake horse power have been working for some time. In a paper read before the Institution of Mechanical Engineers by Mr. H. A. Humphrey, so long ago as 1900, the results of the trial of such an engine are given working with Mond gas. The over-all efficiency $= \frac{\text{E.H.P.}}{\text{I.H.P.}}$ — was 70 per cent., and the gas consumed 52.09 cubic feet of Mond gas per indicated horse power per hour, or 74.42 cubic feet per brake horse power per hour. This corresponds to a thermal efficiency of 30.38 per cent. on the indicated horse power, or, excluding engine friction, 22.87 per cent. and 25.59 per cent. respectively, including and excluding the heat carried away

in the steam. This firm employs single cylinders up to 250 indicated horse power, and two tandem cylinders up to 1,200 indicated horse power, and above 1,200-horse power they are prepared to build double tandem engines with four cylinders. A scavenging charge of air is supplied from a separate cylinder which tends to prevent pre-ignition. The largest engine made by this firm of which the writer is aware is one with 38-inch cylinders, and with a piston speed of 750 feet per minute. Where steadiness of running is of paramount importance, governing is accomplished by reducing the quantity of gas and eliminating blank strokes. Heavy flywheels constructed for high velocities, coupled with this system of governing, insure very great steadiness in running.

Probably the largest engines on the Otto cycle hitherto constructed have been made by the Société Cockerill, of Seraing. Engines with two tandem cylinders, 51-inch in diameter, have been made by this firm, and develop 2,500 indicated horse power. The engines are known as the "Simplex" engines. They are built on a specially strong design, and are arranged for driving by blast furnace gas. The flywheels are of the built up type, so as to run at high rim velocities. Electric ignition is adopted. A benzine carburettor is used for starting, and the flywheels are fitted with barring gear worked by an electric motor where the conditions permit. All the main valves are placed at the lowest part of the cylinder so as to facilitate cleaning.

The Cockerill Company are also building double acting engines.

Messrs. Fielding and Platt build both horizontal and vertical engines, the former up to 300 brake horse power, the latter up to 780 brake horse power. High piston speed is adopted in these larger vertical engines, 900 feet per minute being reached with the 4-cylinder engines. These are of the inclosed type, and an explosion every revolution is effected through a piston valve, so that air and gas are cut off in corresponding proportions, a constant mixture being obtained.

(To be Concluded.)

Safeguards and Regulations in Operation of Overhead Distributing System.

[A paper read by MR. W. C. L. EGLIN, December Meeting Am. Inst. Elec. Engineers.]

The distributing system can be considered as one of the integral portions of a power plant, and it should receive as careful attention as either the steam plant, hydraulic plant, or the electrical plant in the generating station or sub-station. In fact, it would appear that the transmission system has to meet more severe conditions than any other part of the entire plant, so that the safety and reliability of the service depend largely upon the amount of forethought given to the plans and the selection of material.

When it is considered that an overhead distributing system is subjected to many varied conditions, such as the weather, extreme changes of temperature, extraordinary storms, interference from other lines, interference by building operations, excavations, fires and other casualties, and sometimes a wilful interference by the public (not to overlook the small boy with a stone), it should be readily appreciated that all of these varying conditions must be considered in the construction of the line. There are two divisions of conditions: First, the mechanical or structural features, and, secondly, the electrical features.

The first group will include the study of the territory in which the line is to be run, width of streets, kind of buildings, height of buildings; other distributing systems, possibilities of interference with these systems; amount of power to be transmitted, and whether the system consists of a simple power transmission circuit, or one complicated with distributing mains covering the larger part of the territory occupied by the transmission system.

Also to be considered are the weather conditions; windstorms, rainstorms, sleetstorms, snowstorms, lightning storms and changes in temperature from summer to winter. The method of erecting the conductors so that they can be properly repaired or additions made without endangering the lives of the men engaged in this work must be carefully planned. Unless these various points are all considered in the construction of the lines, no rules or safeguards for their operation will be of material benefit.

The second group includes the electrical requirements: The conductors, the insulating method of support, and the means provided to take care of any undue disturbances due to lightning or other causes on the line, such as lightning arresters, fuses, switches, etc.

All of the material entering into the construction of a transmission system should be ordered under specifications which shall clearly set forth the character of the material to be used and also that all of the material will be inspected before it is used on the work, and that tests will be made of samples of all material furnished. The more general requirements are as follows:

Poles.—Poles should be as short as possible to meet the conditions and preferably made of good, sound chestnut. Southern cedar and pine poles are sometimes used when chestnut is not obtainable. It may also be necessary to use iron poles under certain conditions; but iron poles are to be avoided, principally on account of danger to linemen and also to the short life of the pole, due to rusting. The pole should be roofed at the top to form a right angle, and gained to form a flat of about 5 inches from the attachment of the cross arms.

All poles, upon which are located devices requiring regular inspection, should be provided with steps in order to facilitate this work. Spacing of the poles should be carefully considered and should not exceed 40 to 45 yards. End and corner poles should be braced, and at least every tenth pole throughout the line should be guyed with ¼-inch or ⅜-inch stranded galvanized wire. Regular inspections, at least annually, should be made of the condition of the poles, which is most readily determined by examination at the base of the pole. When poles are used as junction poles, that is, when lines are run at right angles and attached to the same pole, special care is necessary. A separate drawing should be made of all such poles, showing the arrangement of the wires—keeping in mind the simplest possible arrangement—as a protection for the men who climb these poles. Switch boxes, fuses, lightning arresters or transformers should not be attached to such poles, but on the first pole removed from this junction pole. Junction poles can frequently be avoided by the use of two poles making a "Y" connection of the line. By this arrangement the connections are very materially simplified.

Cross Arms.—Cross arms should be spaced at least 24 inches between centers, the top of the first arm being 1 foot from the top of the pole.

Braces.—Braces should be made of galvanized iron not less than 1¼ inches by $\frac{3}{16}$-inch thick, and about 28 inches long.

Pins.—The pins should be made of locust wood well boiled in linseed oil, and are preferable for voltages of 5,000 volts and under. For higher voltages, pins should receive special consideration.

Insulators.—The insulator on the pole line fulfils two functions, viz.: The mechanical support of the line, and the insulation. As these conditions vary over a wide range, they must be considered for each condition. This is especially so for voltages of 10,000 volts and over. The two materials of which insulators are usually made are glass and porcelain. The glass insulator is more uniform in quality of material than the porcelain, so that for lower voltages glass insulators are recommended. For higher voltages, porcelain insulators are preferred for the following reasons: Greater mechanical strength, better insulating qualities, and greater ability to withstand severe weather conditions.

Insulators of high voltages should be made up of a number of insulators cemented together so as to obtain more uniform insulation and to increase the factor of safety from defective manufacture. Before being used, each insulator for high tension work should be tested at voltages in excess of the operating voltage.

The method of attaching the conductor to the insulator should be carefully considered; first, to see that the wires can be properly fastened to the insulator, and, secondly, to see that the strain is transmitted without a twisting or bending strain in the insulator; the only strain permitted should be in compression.

The method of distributing the wires on the pole lines depends on the number and character of the various circuits to be installed. For all voltages below 6,000 volts, the wire should be brought out of the station through long porcelain tubes, properly supported; the various circuits being grouped together but well spaced, and preferably being distributed in a single, or not more than a double row of wires. This fan effect allows the circuit to be distributed to the poles without any undue bunching, thus making each circuit easily distinguishable.

The top gain of all poles should be left vacant so that guard wires can be placed at any point on the line, should they be required. The transmission circuits which are alive 24 hours per day should be placed on the top arm; that is, the trunk lines should occupy the position where there will be the least liability of coming into contact with the other wires or with the men working on the poles. All other circuits should be placed below series arc circuits occupying the lower arms, the distributing series circuit being placed on the house of the lower arms on outer pin occupied by such circuits. The bottom cross arm should be used for such secondary circuits or low tension lines as may be required. Space should always be provided for an extra arm on the pole for the erection of a transformer. Protective devices for each circuit may be classified as follows: Circuit breaker, fuses for branch cir-

cuits, and lightning arresters. Also indicating instruments as follows: Voltmeter, ammeter or wattmeter, and ground detectors.

In the arrangement of the protective devices, it is desirable to locate as many of these as possible in the station or sub-station, for the reason that they are more readily inspected and kept in perfect working order, which insures the fulfilling of their functions when required. All circuits of 200-kw. capacity or over should be protected by means of oil circuit breakers in preference to fuses, on all voltages over 1,000 volts. These circuit breakers should be attached to both ends of the line, when two or more feeders are used and connected to the same bus; and there should be no other circuit breaker or fuses which are automatic in action placed at any other part of the line. Small branch circuits may be taken care of when necessary by fuse boxes, placed upon the first pole of the branch circuit. These fuse boxes, however, should be avoided whenever possible. This can be accomplished by making a branch circuit about the same as the main circuit, depending entirely upon the circuit breaker in the station to protect both lines. When small branch circuits are desired, place such fuse boxes. These preferably should be an inclosed fuse of the cartridge type mounted on a porcelain base, the whole inclosed in a fireproof and waterproof compartment. This is usually an iron box with a cover and rubber gasket, clamped so as to make it water tight.

Lightning Arresters.—Lightning arresters should be installed at both ends of the line, in the station and sub-station, on each conductor. Special care should be used in their installation, and provision made that in the event of a breakdown of the lightning arrester, current may be interrupted by means of a circuit breaking device.

Series Arc Loop Cutouts.—These should consist of a mechanically operated switch which closes the circuit at the point of the loop and disconnects the loop from the main line. For the use of constant potential circuits there may be either a fuse box provided with solid catches or fuses depending on the conditions. All of these devices being inclosed in fire and waterproof cases.

Before considering the actions of the safety devices, it is necessary, first, to examine the faults which may develop and the functions which the safety devices are required to fulfil. If the condition of a wire parting is first considered, we have first the liability of the wire coming in contact with some of the other circuits; secondly, its liability to fall into the street, and, thirdly, its remaining suspended clear of all circuits and the ground.

The first condition: The effect of coming in contact with other wires would immediately raise the voltage to the more powerful of the two circuits, so it is evident that the insulation of the other circuit must either be as good or there will be a liability of the insulation breaking down at some point on the weaker circuit. This will first be detected at the station by showing that the load is dropped from this circuit, and it demonstrates that the insulation of all circuits must be the same when placed on the same pole line, unless means are provided to take off extraordinary high voltages. This can be done by placing spark gaps, which will relieve the high tension from any low tension circuits, or by grounding a point on the lower extension circuits.

Wires falling on the ground will indicate immediately in the station, on the ground detector, that there is a ground on that circuit, and instructions should be given that as soon as a ground shows on the circuit and the circuit is not carrying the load, to disconnect it.

The third condition will indicate in the station that the load is dropped and will not show a ground. The circuit should be cut off in this case also, and inspectors sent out to look after the trouble.

Fourthly, if a wire breaks and falls, crossing other wires of the same circuit, this will cause a rush of current on constant potential circuit and immediately open the circuit breaker. In the series arc circuit it will cut out a portion of the circuit which will be indicated on the voltmeter, showing the necessity of regular voltmeter readings on such circuits.

Interference with Other Wires Falling or Coming in Contact with the Power Circuits.—If these wires cross the power circuit and drop loosely on them, the effect will be to short circuit the power circuit on constant potential circuits; the defect develops immediately. The wires either burn off or an arc may be established which will burn off the power circuit, breaking the wires and the connection. The provision should be as the conditions shown for the breaking of a wire. A single wire may merely come in contact with one wire of a constant potential circuit and assume the same voltage as that circuit; there will be no way of determining this at either the station or the sub-station, unless that wire was grounded and the ground indicated on the ground detectors. In the event of this falling wire coming in contact with both sides of the series arc circuit, a portion of the circuit will be cut out and indicated on the voltmeter at the station. Should it come in contact with only one wire of the circuit, no indication will be made at the station unless the wire be grounded. For this reason inspection should be made and all such wires changed so as to come before the power circuit and not above it. This also demonstrates the necessity of placing protective devices on foreign wires which may come in contact with power circuits.

Lightning Storms.—The installing of efficient lightning arresters as specified may protect the apparatus at both the generating station and sub-station, but fail to protect apparatus at intervening points, particularly the transformers. It is possible that lightning may jump from primary to secondary of transformers during a severe storm. This would be indicated by the primary fuse blowing in the transformer, and after the blowing of the fuse from this cause, tests should be made of the transformer as follows:

It is essential that when a primary fuse on a transformer is blown through any cause, the secondaries should be disconnected from the transformer, and the latter tested to full line voltage between the primary and secondary coils, so as to determine that there is no breakdown in the insulation between these coils.

There are two methods by which these tests may be readily made by the linemen without removing the transformer: First, take from the station a 600-watt transformer, connect its primary for the line voltage and its secondaries for 100 watts, and connect a 50-volt lamp across the latter. Attach one primary lead of this test transformer to one secondary wire of the line transformer, and place 1-ampere fuse in the primary cutouts protecting the line transformer. Now connect the other primary lead of the test transformer, first to one and then to the other of the main primary lines. If the 50-volt lamp filament becomes red, the line transformer is defective and should be returned to the station.

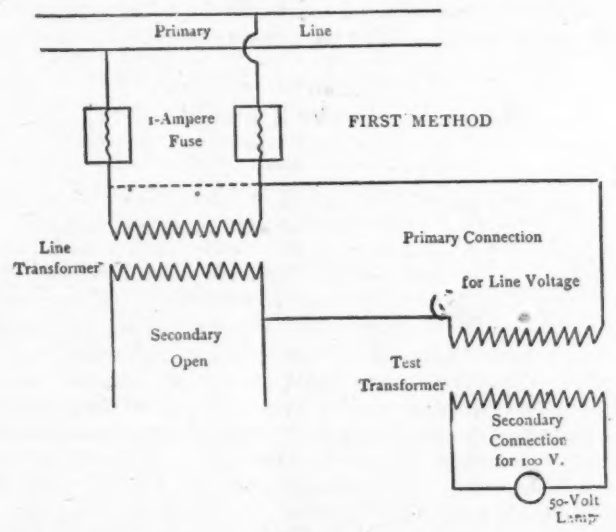


Fig. 1.

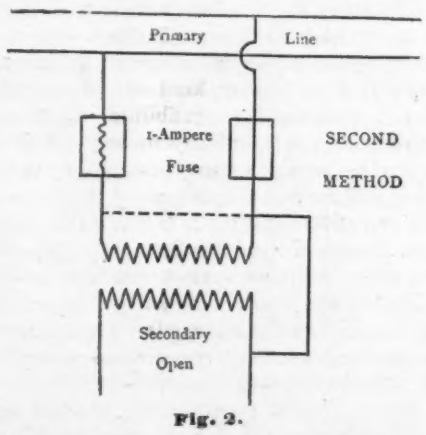


Fig. 2.

Second method.—If impossible to use the first method, proceed as follows: Attach a short piece of heavily insulated rubber wire to one of the secondary wires leading from the transformer. Then place 1-ampere fuses in the cutouts, and connect the specially insulated rubber wire first to one and then the other of the main primary lines. If the fuse blows, or a spark shows when contact is made, the transformer is defective and should be removed from the line.

In the event of lightning arresters being placed on the pole line, all

such lightning arresters should be inspected after each heavy lightning storm.

Transformers.—Transformers when supported on the poles should be hung on an extra cross arm provided for that purpose. The primary leads from the line to the fuse box and to the transformer should be insulated with rubber covered braid, for the line voltage. Transformers should not be attached to buildings or in such locations as to be handled by unauthorized people, and when they are placed in buildings they should be put in a separate fireproof closet or room which is controlled only by the operating plant. As it is now the general practice to use oil transformers it is unnecessary to consider dry transformers. Inspection should be made to see that the cases are properly filled with oil. This should be done by an inspection force, and not by the men erecting the transformers.

Inspection.—The greatest safeguard in a transmission line is regular inspection. Lines can with advantage be inspected daily, not only on inspection from the ground, but a regular monthly inspection of all devices attached to the line when a continued service is desired.

It may be necessary on some parts of the line to introduce cable. This should be avoided whenever possible for the reason that the conductors are brought close together at this point and static discharge is liable to puncture the insulation; so means should be provided at both ends of the cable to take care of the static. This is best arranged for by a series of gaps of the lightning arrester type. Standard lightning arresters can usually be used for this purpose. They should, however, be provided with a small fuse in series with the connection to the line so as to prevent short circuiting the lines in case of failure of the spark gaps.

An Electrically Operated Laundry.

[By Mr. H. G. Ward, in *Electricity.*]

There has recently been erected in Washington, D. C., a laundry plant representing in round numbers an expenditure of $100,000, and it is without doubt one of the finest, if not the finest plant of the kind in the world. It is known as the Yale Laundry, the proprietors being F. H. Walker & Co. Increasing business rendered it necessary for the Company to have larger quarters and Mr. Walker decided to erect a plant which would represent the latest phases of mechanical operations as applied to laundry work. He visited many different laundries throughout the country, as well as machine shops and electrical plants, for the purpose of deciding upon the latest and most improved means of machinery and appliances. All this investigation and probing and observation is now seen in the completed plant on New York avenue.

The building is a very commodious and imposing structure, the frontage being 60 feet and the depth 135 feet. It is 3 stories high, with an attic, and is of iron and hard red brick laid in cement. The equipment in the engine room consists of a 115-horse power American Ball engine direct connected with a 75-kw. generator. The switchboard is of marble, has 3 panels and is mounted with the latest improved Weston instruments. Adjoining the engine room is the boiler room, which contains two horizontal tubular Keeler boilers developing 300-horse power, with a Green fuel economizer for heating water. The water used in the plant is filtered in two tanks on the roof, with a capacity of 6,000 gallons each. One is used to supply hot water, which is passed from the tank through the Green fuel economizer to a feed water heater, the exhaust from the engine passing through the heater. This insures an unlimited supply of water at practically no cost. The entire plant is heated with steam by means of the exhaust of the engine passing through radiators, and the cost is nothing.

The first thing that strikes one upon entering this plant is that there is almost an utter absence of the old mechanical appliances in the working departments, and of all those devices by which machines are operated, for there is practically no shafting, no belting and no pulleys to be seen, most of the machines being operated by electric motors. The electric plant of the building controls the operating machines through individual motors. Only such machines as are in actual use are the ones that consume force. This is, therefore, the greatest conservation of force and energy that has been seen up to date in any laundry, because such force only is applied to the machine in operation as is necessary for it in its work, as an individual motor operates each machine, and when that machine is not required for operating purposes, that individual motor ceases. This concentrates at once all the force upon those machines that are in use, and there is no dissipation of force or energy possible. No one can understand what this means who has not worked in laundries where shafts, belts and pulleys are used, and where this enormous power is disintegrated or lost constantly through the lack of ability to control it. By means of the electric system and the individualizing of concentrated power nothing in the way of force is lost, and its application is so modified and amplified that it comes under absolute scientific control over the whole plant.

In addition to the electricity as developed in its motors and applied to the machines, there is an elaborate electric light plant which places over each division, section and individual worker such light as may be required after dark, but in the daytime, except in the winter months, the four sides of the plant being well lighted and it being impossible for any part of the building to be infringed upon, there is such a quantity of natural light distributed that the very centers of the floors can be used for operating purposes.

While electricity has been applied in plants in various ways and directions and means, it is believed that it has never yet been scientifically put into use as in the Yale laundry, because, as a matter of course, old plants cannot install these electrical improvements profitably or in a manner which would do justice to the claims of their makers, or to the system that is necessary to bring forth the best results. Therefore, in the Yale laundry we see for the first time the application for the control of machinery on a scientific basis. It is a magnificent scheme, which will add precision and finish to the work and efficiency to the workmanship, the fundamental requisites of high grade laundering.

A brief description of some of the machinery may not be without interest. The 4 shirt starchers and 2 neck and waistband starchers are operated by a 20-foot shaft on floor hangers and are run by a Crocker-Wheeler 1-horse power motor with sprocket pulley and Morse chain. There are also two bosom press machines and two wristband presses, which are run with a shaft on floor hangers and are back to back, the electric motor operating them being 1-horse power. It might be stated here that all the motors are of the Crocker-Wheeler make.

The shirt ironing outfit is one of the most interesting parts of the whole equipment of the plant. The outfit is composed of four lines of machines of four machines each. They are hitched tandem and are operated by a Morse chain covered with steel rail guards, connected with a 1-horse power motor between body ironer and wristband ironer. One of the largest laundry machinery houses in this country especially designed the covering for the cogs necessary in the tandem machines. This is something that has never been done before in this particular field, but it is entirely feasible and in the present case works admirably. There are a number of other machines operated by electric motors ranging from ¼ to 1-horse power, and their arrangement and method of operation leave nothing to be desired.

There are two elevators in the plant, one being a direct connected passenger elevator, running from the office to the upper floors, and the other a large electric freight elevator, equipped with safety doors above the first floor. An elaborate private telephone system forms also a part of the equipment of this model and up-to-date plant.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Mr. George H. Soult has been appointed Superintendent of the Ridgewood (N. J.) Gas Company.

Mr. H. L. McKee, President of the Meridian (Miss.) Gas Light Company, writing under date of the 20th inst., says: To the Editors American Gas Light Journal: The Journal of December 28th last contains an article over the name of Mr. James Somerville, in relation to Mr. Frederic Egner's views on low candle power gas for Welsbach lights, in which he takes issue with him, and questions his statements that a low grade gas is most suitable for the Welsbach burner. I quite agree with Mr. Somerville, and give my testimony that nothing under 17-candle power will yield a proper incandescence in a Welsbach mantle. I maintain ordinarily 19 to 20-candle power to give the best light, and by this course we force out the electric light.

Mr. Thomas H. McComb, for 20 years or more in the employment of the old Poughkeepsie (N. Y.) Gas Company, has resigned.

The Board of Gas and Electric Light Commissioners has issued an order recommending that on and after the 1st inst. the price of gas to be charged by the Marlboro Gas Light Company shall not exceed $1.75 per 1,000 feet for illuminating purposes and $1.50 per 1,000 feet for fuel purposes. At the time the petition was filed, the gross price for gas for illuminating purposes was $2.50 per 1,000, and on an average $2 net, but since the filing of the petition the Company has reduced prices from 12½ to 25 per cent. Consumers criticised the Company for varied discounts given, net prices varying from $1.75 to $2.50. The order of the Board makes a general discount.

The annual meeting of the shareholders in the Springfield (O.) Gas Company will be held in that city this afternoon.

At the annual meeting of the Salem (O.) Gas Company the officers elected were: Directors, W. C. Boyle, F. J. Mullins, R. V. Hampson, T. T. Church and W. H. Koll; President and Secretary, W. C. Boyle; Treasurer, R. V. Hampson.

On the 1st inst. the selling rate at Sioux City, Ia., was put at $1.15 per 1,000 cubic feet.

The Binghamton (N. Y.) Gas Company has moved into new quarters in the handsome building erected by it on Chenango street. The building is a credit to the Company and an ornament to the city. Call on Manager Wheeler when business or pleasure or any other cause calls you to Binghamton and you will agree with us in our judgment concerning the Company's business home.

Mr. F. Andres, of Lexington, Mo., is persisting in his attempt to secure a franchise for the right to construct and operate a gas works in Mexico, Mo.

The Hamilton (O.) Gas Light and Coke Company is preparing to extend its main system to the outlying district of Glendale, the residents of which place have been clamoring for a gas supply for some time.

The officers of the Connecting Gas Company, of Cleveland, O., have filed a certificate announcing an increase of the capital stock from $500,000 to $825,000.

The Louisville (Ky.) Gas Company, owing to greatly increased business and the consequent crowd and delay of those making payment at the office, by reason of the limited number of discount days, has decided to increase the number of divisions in which payment can be made from 3 to 13. Payments, however, may still be made at the different express agencies, as heretofore established.

A correspondent forwards the following from Chicago under date of the first inst.: "The Ogden Gas Company of this city during 1903 has increased its businees fully 25 per cent. over that done during the previous year and is now doing the largest business ever done during the history of the Company. While its street mains have not been extended to any considerable extent, the Company has found it all it could possibly do to meet the constantly increasing demands of new consumers along the line of mains heretofore laid. With all the new machinery and apparatus installed during the previous year, it has not only been able to hold its own, but to furnish gas to who needed and demanded it, in its territory. The general public has shown beyond all question it fully appreciates the fact this Company has given them the 90-cent rate, while before its coming the rate lower than $1 had never been known. The same privileges will be extended to the Company's patrons during the coming year as during the year past in the way of gas ranges, piping and fixtures, arc lights, water distillers, etc., which may be paid for in cash or bought on the easy payment plan, and for this purpose it has provided a sales department at 653 North Clark street, where these appliances can be shown the consumer and can be fully tested, and their uses and merits clearly understood by him. The increase of business has been so pronounced that the Company has outgrown its old quarters in the office which it has heretofore occupied and has been forced to seek larger accommodations elsewhere. In consequence of this it has just closed a long lease upon the premises at 115 Dearborn street, it being the building in which the old National Bank of Illinois was located for so many years, and after a few weeks' time necessary to the proper refitting the Ogden Gas Company will move to this new office and make its headquarters there. This new office, it is believed, will excel anything of the kind used for the same purpose in the country."

Mr. R. H. Hamilton, foreman of the plumbers and fitters in the employ of the Easton (Pa.) Gas Company, was surprised the other evening when he found that his domestic furnishings had been increased by the addition of a handsome easy chair of the Morris pattern. An up-to-date smoking jacket was also in the "surprise." The gifts were from "his men."

The proprietors of the Beverly (Mass.) Gas and Electric Company have petitioned the Board of Gas and Electric Light Commissioners for the right to increase the capital stock in the sum of $78,000.

The proprietors of the Syracuse (N. Y.) Lighting Company have assented to the arguments of General Manager John J. Cummins, who in April last advised that the selling rate be put at $1 per 1,000 cubic feet. The Directors will in a few days announce when the new schedule will become effective. If we mistake not, the present selling rate is $1.30.

The annual report of the Superintendent of Lamps and Lighting (Mr. R. J. McCuen) for Baltimore, Md., shows that the electric, gas and naphtha street lighting service during 1903 was operated under the same contract as in 1902. The electric contract will, however, expire Sept. 13, 1905, the gas lighting contract on March, 1, 1904, and the naphtha contract Dec. 31, 1905. The gas lighting contract for 1904 has been awarded to the present contractors at $13 a lamp a year, $1.15 a lamp less than the present cost. The following number of lamps was in service on December 31: Electric, 1,602; gas, 6,373; naphtha, 1,089. The contract for supplying gas to the city was awarded June 1, 1903, to the Consolidated Gas Company for two years for $7.25 a lamp per annum, as against $10.13 prior to June, 1900. During the year 28,815 gas meters were inspected, tested and sealed for the Consolidated Gas Company, at a fee of 25 cents, and 137 gas meters were inspected, tested and sealed for complaining consumers at a fee of $1. The Consolidated Gas Company raised the point that it has no legal right to pay to the city this fee of 25 cents and has refused to pay it since last May. The City Solicitor has advised the department to continue to inspect and test these meters pending a settlement. During the year 200 gas lamps, 50 naphtha lamps and 37 electric arc lamps have been installed in various sections of the city, a large number of these lamps having been placed in dark alleys, so that at the present time almost every alley in the city is thoroughly lighted. Street signs have been placed on unused gas lamp posts on Chase street at every intersecting street from Greenmount avenue to Broadway, on North avenue at every intersecting street from Pennsylvania avenue to 12th street, Walbrook and at the intersection of every street throughout Forest Park. Arrangements have been made to place signs of similar design throughout the city. Five recording pressure gauges have been purchased and are on hand ready to be installed in as many different sections of the city without any expense. The object is to ascertain the exact pressure in every section of the city. During the year nearly 7,000 lamp posts and lanterns throughout the city were painted, repaired and put in first-class condition. The special illumination of the streets, public buildings, parks and squares of the city from June until October 15, 1903, was a notable feature in connection with the various conventions held here during that time. The total appropriation for this special illumination was $25,000 and the total expense for the equipment and construction amounted to $24,832.35, leaving a balance of $167.65. The total appropriation was $336,689.11; total expenditures, $326,193.42; balance, $10,495.69. Out of this balance provision had been made for $7,959.62 for the payment of bills for the month of December, 1903, usually paid out of the appropriation for the next year succeeding. This arrangement still leaves a net balance December 31, 1903, of $2,536.07.

Mr. A. H. Merritt, of the Niagara Falls (N. Y.) Gas and Electric Company, has greatly improved in the art of carving. The advance is, at least in part, attributable to the receipt by him of an elegant carving set, mounted in silver, recently presented him by the employees of the Company.

The application for a charter for the West Allis (Wis.) Gas Company is now before the judiciary committee of the West Allis Council. The Company asks for a 25-year grant, the first 15 years thereof to be exclusive, and it agrees to sell gas at the rate of $1.20 per 1,000.

The City Council, of Three Rivers, Wis., has granted to Messrs. Noble, Moss & Company, of Detroit, a franchise for the construction and operation of a gas works.

According to the Brooklyn (N. Y.) *Daily Eagle* more than the necessary majority of the stockholders of the Brooklyn Union Gas Company, at the special meeting held the 30th ult., voted in favor of the proposition to increase the capital stock of the Company from $15,000,000 to $20,000,000. The exact number of shares voted was 113,649, out of a possible 150,000. There was no opposition. Few stockholders attended in person. Proxies for their holdings were in the hands of the President and Secretary of the Company, who voted them in accordance with the instructions of the owners. The details of the plan have been given heretofore. Pending the issue of the stock it is proposed to issue and sell convertible debentures in sufficient amount to provide $3,000,000, the proceeds of this sale to be used to meet the requirement of the Company in its increasing business. Of the increased capital stock 30,000 shares are to be held for the redemption of the debentures above mentioned. The remaining 20,000 shares of the increase are to be sold or disposed of as the Directors may decide, and whenever it becomes necessary to provide additional funds for the business of the Company. The debentures are to be issued in denominations of $1,000 and $500 each, are to bear interest at the rate of 6 per cent. per annum, payable semi-annually on September 1 and March 1, and convertible, at the option of the holder, into stock on the basis of one share of stock for each $100 par value of debentures with unmatured coupons, on and after 3 years from the date of issue of the debentures on any day when a coupon falls due. Unconverted debentures shall be mature and be redeemed in cash at face value 5 years after date of issue. Each stockholder may subscribe for debentures to the extent of one-fifth of his holdings. Blanks for subscriptions and for the sale of rights will be prepared within a day or two, and then the Directors will meet to decide upon the date for the closing of the books.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
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NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, JANUARY 11, 1904.

The Market for Gas Securities.

The local gas share market during the week was dull, and trading was accomplished at lower figures. Consolidated was quoted at the close to-day (Friday) at 192 to 192¼, and the tone was weak. Sporadic inquiries were made for Standards, both common and preferred, but there was little if any actual business done, buyers and sellers being about 15 points apart. In 1903, 541,786 shares of Consolidated gas were sold on the Exchange. The highest figure was 223 and the lowest 164. City gas bonds continue in good demand.

Brooklyn Union shows no change. The nominal bid price to-day at the close was 205 to 217. The exact date and way for holders to acquire the authorized issue of new stock will be given out likely next week. During the year 17,617 shares of Brooklyn Union were sold on the Exchange, the high price being 239 and the lowest 170. The Company's business is amazing as to its growth. Peoples, of Chicago, closed to-day at 97¼ to 97½. The number of shares of this stock sold on the Exchange last year was 682,976, the high point having been 108¼ and the low 87¼. Baltimore Consolidated is a trifle weak, without any good reason therefor.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

JANUARY 11.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	192	192¼
Central Union, Bonds, 5's	3,000,000	1,000	104	106
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	118	120
Metropolitan	658,000	..	108	112
Mutual	3,500,000	100	260	275
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co. ..				
Bonds, 5's	11,000,000	1,000	103	105
Northern Union, Bonds, 5's	1,250,000	1,000	105	106½
New York and East River ..				
Bonds 1st 5's	3,500,000	1,000	102	106
" 1st Con. 5's	1,500,000	..	109	111
Standard	5,000,000	100	135	140
Preferred	5,000,000	100	155	170
Bonds, 1st Mortgage, 5's	1,500,000	1,000	116	117
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	205	217
" " Bonds (5's)	15 000,000	1,000	113	115
Bay State	50,000,000	50	⅛	3/16
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	28	30
" 1st Mtg. 5's	500,000	1,000	93	96
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	6½	8
" " Bonds, 5's	5,250,000	1,000	73	76
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas & Elec. Co.	29,500,000	100	97½	98
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	101	101½
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	88¼	89¼
Preferred	3,026,500	100	107½	109
Consumers, Jersey City Bonds	600,000	1,000	100	102
Consumers, Toronto	1,700,000	50	218	225
Consolidated, Baltimore	11,000,000	100	38¼	50
Mortgage, 6's	3,000,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	86	90
Consolidated G. & E. Co.'s.				
Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	..	50
" Prior Lien 5's	5,603,000	1,000	99½	100
Detroit Gas Co., 5's	381,000	1,000	75	75¼
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	30	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	15	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	245	265
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	101	103
Indianapolis	2,000,000	..	50	65
" Bonds, 6's	2,850,000	..	103½	106½
Jackson Gas Co	250,000	50	73	75
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,222,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	79	90
Preferred	2,500,000	100	90	..
Bonds	10,000,000	1,000	109½	110
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	138	140
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	850,000	1,000	107½	108½
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	184¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	58	58
Bonds, 6's	4,000,000	..	105	105¾
New Haven	1,000,000	25	250	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	97¼	97½
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	..
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	15,800,000	100	67	67¼
St. Joseph Gas Co.				
" 1st Mtg. 5's	751,000	1,000	92	96½
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	113½	115
General Mortgage, 5's	2,465,000	1,000	92	93
Syracuse, N. Y.	1,975,000	100	46	48
Bonds	2,047,000	1,000	94	96
Washington, D. C	2,600,000	20	288¾	290
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	..	..	..
Wilmington, Del	600,000	50	232	..

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DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT CO.,
N. W. CORNER BROAD AND ARCH STS.,
PHILADELPHIA, PA., Dec. 9, 1903.

The Directors have this day declared a quarterly dividend of 2 per cent. (one dollar per share), payable Jan. 15th, 1904, to stockholders of record at the close of business, Dec. 31, 1903. Checks will be mailed.

1488-5 LEWIS LILLIE, Treasurer.

POSITION WANTED.

GAS ENGINEER,

Energetic and fully acquainted with modern systems of making coal gas, horizontal as well as inclined, is open for engagement. Can construct, build and operate works, with guarantee of highest and best results. Address,

1490-3 "PROGRESS," care this Journal.

SITUATION WANTED

As Manager or Superintendent of a Water Gas Plant,

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1484-tf Care this Journal.

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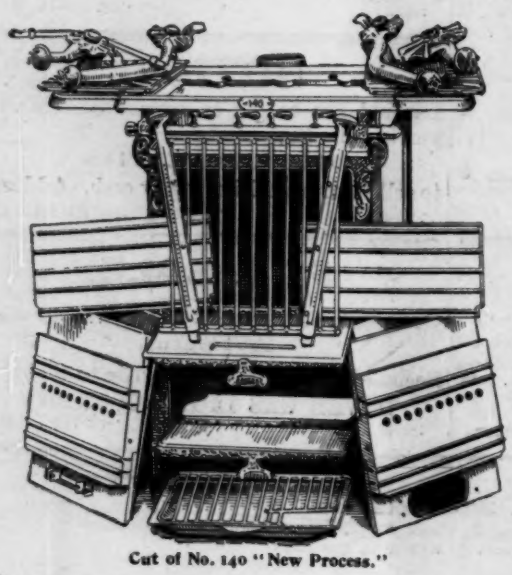
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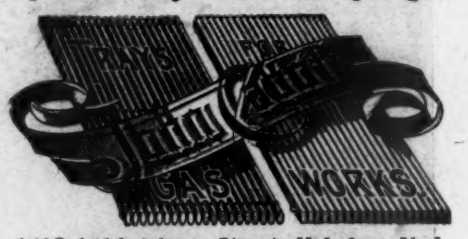

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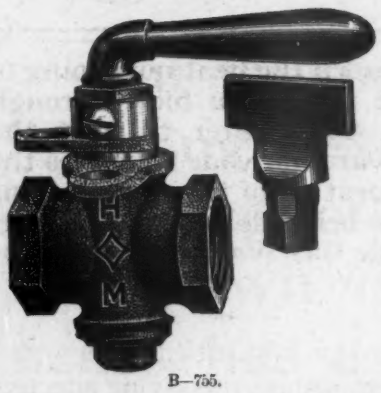

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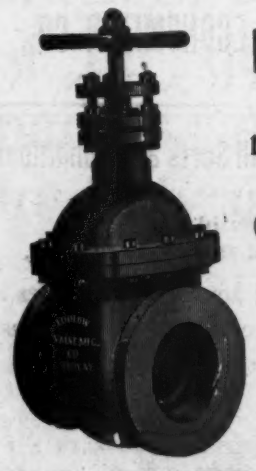

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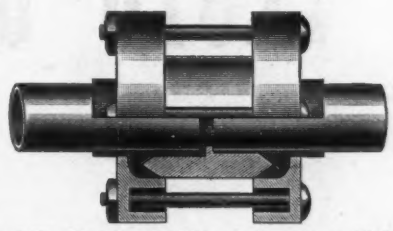

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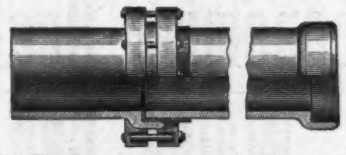

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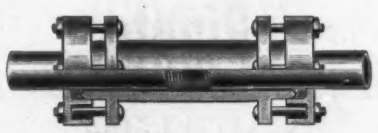

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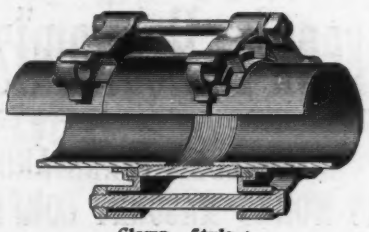

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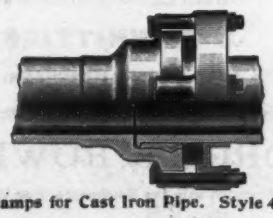

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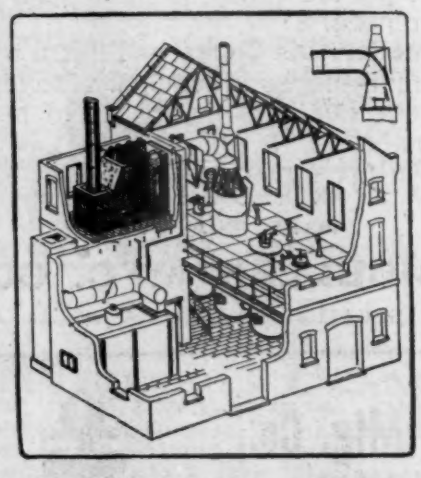

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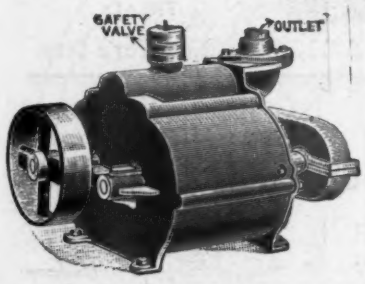

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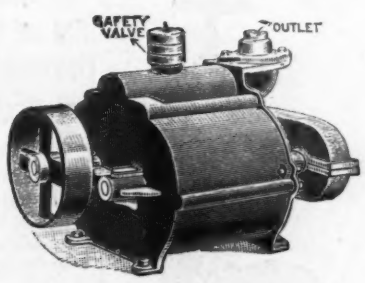

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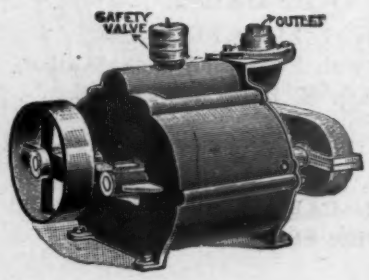

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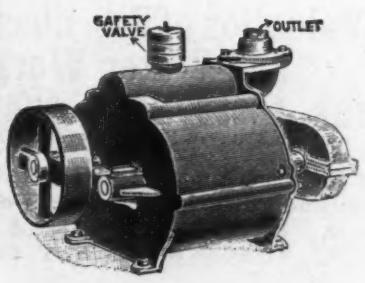

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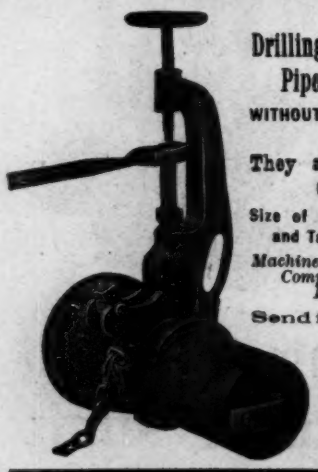

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IS A QUICK SELLER.

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By G. LIECKFELD, C.E.

Translated with Permission of the Author, By GEO. M. RICHMOND, M.E.

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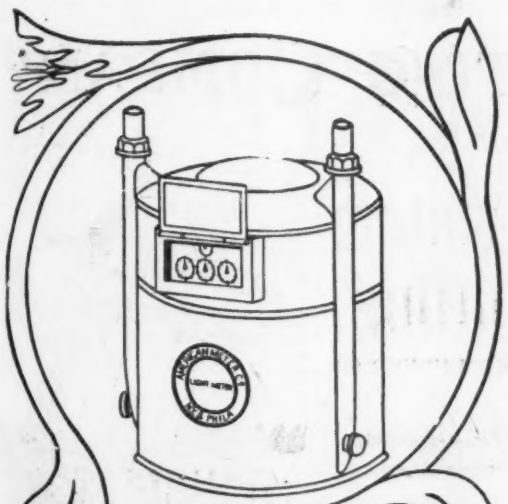

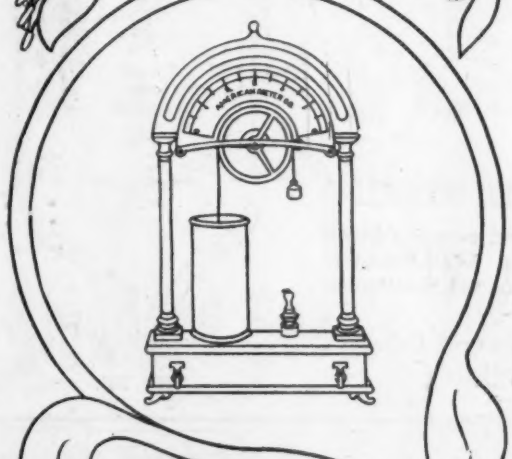

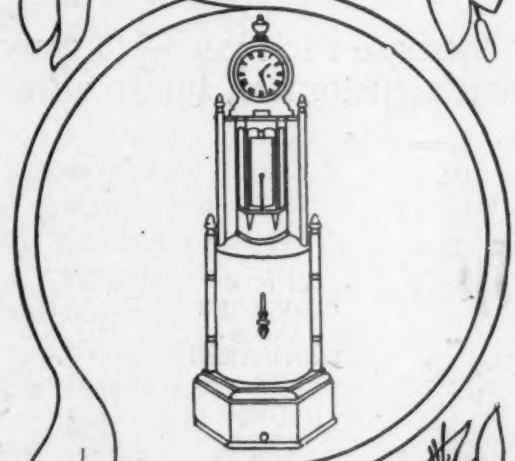

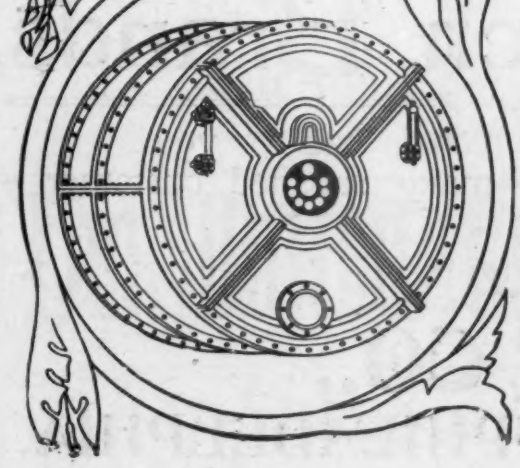

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SAN FRANCISCO.

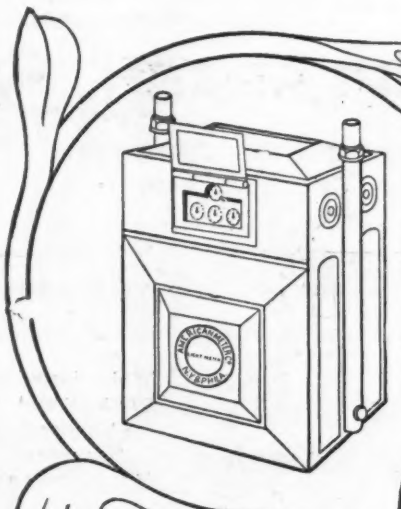
PUBLIC LIGHTING TABLE.

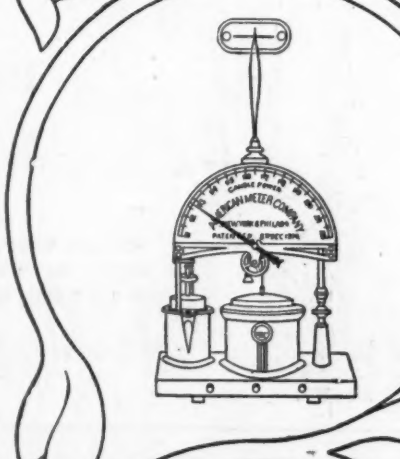
JANUARY, 1904.

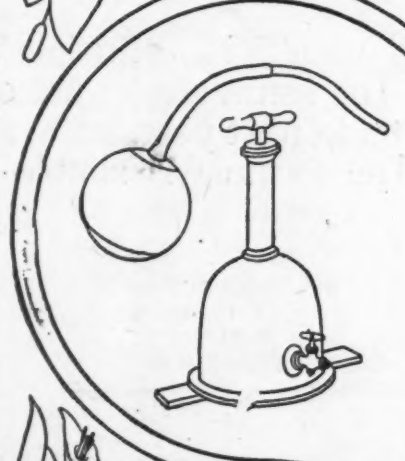
Day of Week.	Table No. 1. Following the Moon.			Table No. 2. New York City. All Night Lighting.	
	Date.	Light.	Extinguish.	Light.	Extinguish.
				P.M.	A.M.
Fri.	1	No L.	No L.	4.30	6.30
Sat.	2	No L. FM	No L.	4.30	6.30
Sun.	3	No L.	No L.	4.30	6.30
Mon.	4	5.20 PM	7.50 PM	4.30	6.30
Tue.	5	5.20	9.00	4.30	6.30
Wed.	6	5.20	10.20	4.30	6.30
Thu.	7	5.20	11.30	4.30	6.30
Fri.	8	5.20	12.30 AM	4.40	6.30
Sat.	9	5.20 LQ	1.40	4.40	6.30
Sun.	10	5.30	2.40	4.40	6.30
Mon.	11	5.30	3.40	4.40	6.30
Tue.	12	5.30	4.40	4.40	6.30
Wed.	13	5.30	5.30	4.40	6.30
Thu.	14	5.30	6.20	4.40	6.30
Fri.	15	5.30	6.20	4.50	6.25
Sat.	16	5.30	6.20	4.50	6.25
Sun.	17	5.30 NM	6.20	4.50	6.25
Mon.	18	5.30	6.20	4.50	6.25
Tue.	19	5.30	6.20	4.50	6.25
Wed.	20	5.30	6.20	4.50	6.25
Thu.	21	5.30	6.20	4.50	6.25
Fri.	22	9.00	6.20	5.00	6.25
Sat.	23	10.00	6.20	5.00	6.25
Sun.	24	11.00	6.10	5.00	6.25
Mon.	25	11.50 FQ	6.10	5.00	6.25
Tue.	26	1.00 AM	6.10	5.00	6.25
Wed.	27	2.00	6.10	5.00	6.25
Thu.	28	3.00	6.10	5.00	6.25
Fri.	29	4.00	6.10	5.05	6.15
Sat.	30	5.00	6.10	5.05	6.15
Sun.	31	No L.	No L.	5.05	6.15

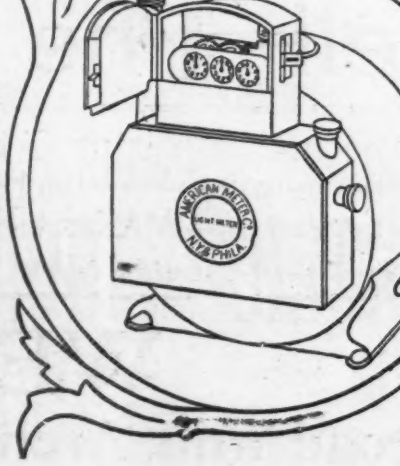
TOTAL HOURS LIGHTING DURING 1904.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	225.00	January	423.20
February	205.40	February	367.40
March	187.40	March	355.35
April	169.50	April	298.50
May	152.30	May	264.50
June	137.20	June	234.25
July	138.50	July	243.45
August	151.00	August	280.25
September	164.40	September	321.15
October	191.30	October	374.30
November	210.30	November	401.40
December	237.10	December	433.45
Total, yr.	2171.40	Total, yr.	4000.00









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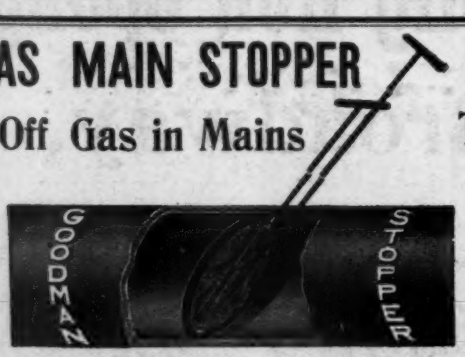

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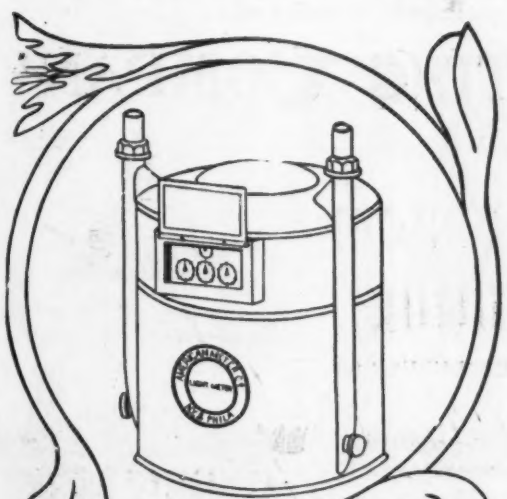

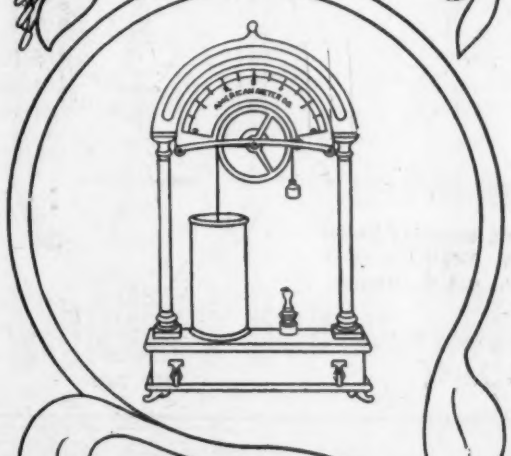

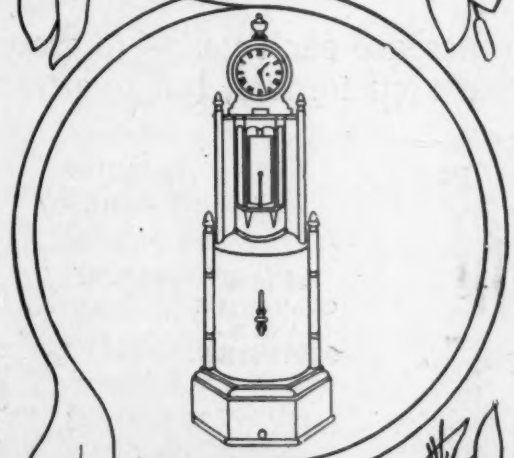

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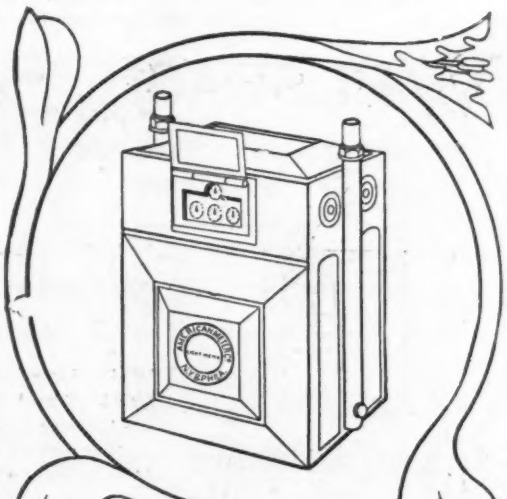

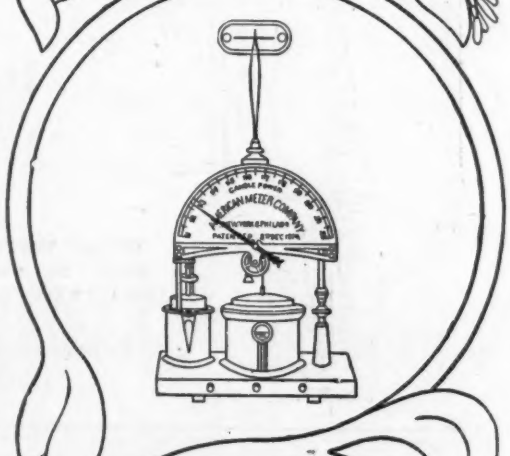

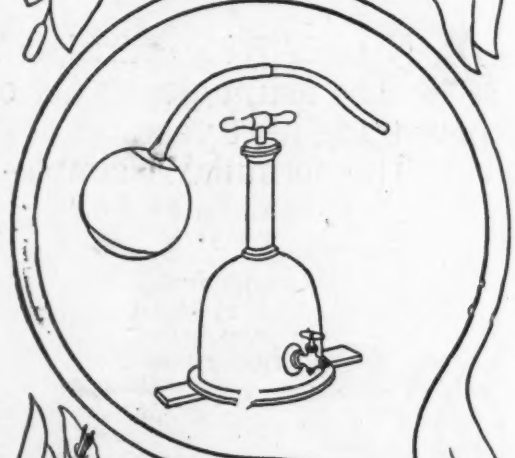

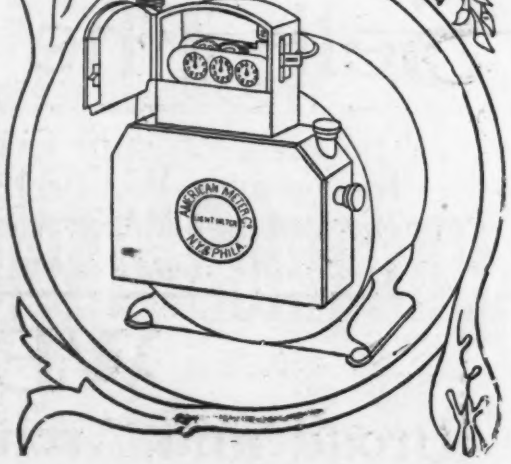

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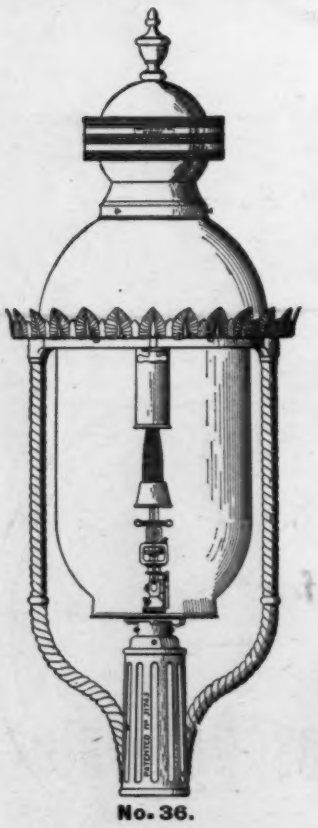
CLEVELAND, 809 Cuyahoga Building. ST. LOUIS, 712 Roe Building. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



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IT LIGHTS THE STREET.

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No. 38.

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The imitation stuff is bad for the customer---which is bad for you.

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And your profit isn't merely dollars and cents.

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THE UNITED GAS IMPROVEMENT COMPANY

For the Months Ending October 15, 1903, has been Awarded Contracts in the Following Places for

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Baltimore, Md.	Chester, Pa.	Savannah, Ga.
Chicago, Ills.	Lynn, Mass.	New York (Central Union Co.)
Amesbury, Mass.	Newark, N. J.	Cicero, Ills.
Aberdeen, S. D.	Washington, D. C.	Chicago (Ogden Co.)
Winsted, Conn.	Boone, Ia.	Easton, Pa.
Canon City, Col.	Pueblo, Col.	Lawrence, Mass.
Schenectady, N. Y.	Charlotte, N. C.	Council Bluffs, Ia.
Hagerstown, Pa.	Fall River, Mass.	Chattanooga, Tenn.
Malden, Mass.	Duluth, Minn.	Tuckerton, N. J.
Bridgeport, Conn.	New York (Mutual Co.)	Springfield, O.
Albert Lea, Minn.	Waltham, Mass.	Easton, Pa. (2d contract).
Brooklyn, N. Y.	Dover, Del.	Mobile, Ala.

TOTAL DAILY SETS TO OCTOBER 15, 1903, ... 55
TOTAL DAILY CAPACITY, ... 56,600,000 cubic feet.
TOTAL SETS TO DATE, ... 502
TOTAL DAILY CAPACITY, ... 356,280,090 cubic feet.

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Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

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Proprietors for the U. S., Coze System of Inclined Benches.

Estimates Furnished on Application for Most Successful Style of Construction.

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Modern Recuperative Furnaces.

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OFFICE, 418 to 422 East 23d St., N. Y.

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BENCH SETTINGS,
Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT

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By HENRY O'CONNOR.

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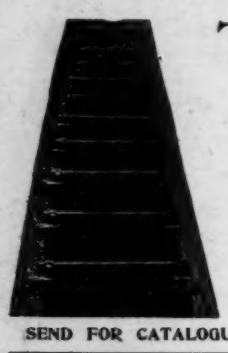

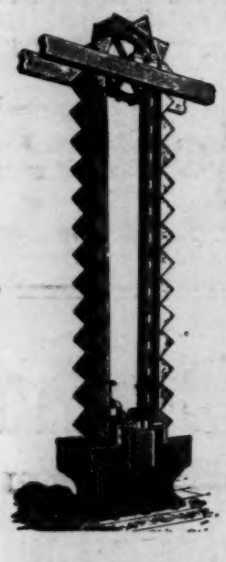

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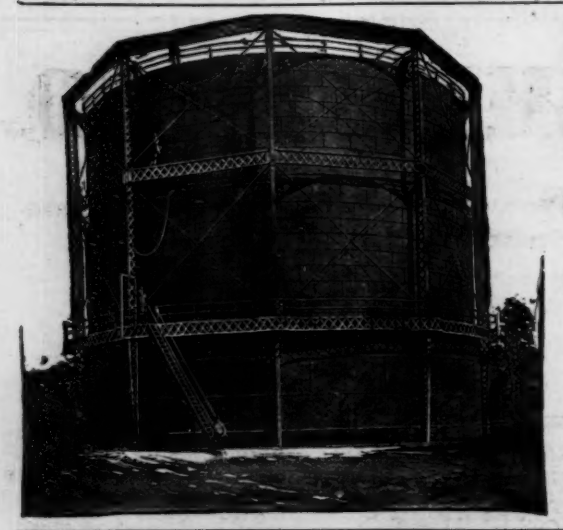

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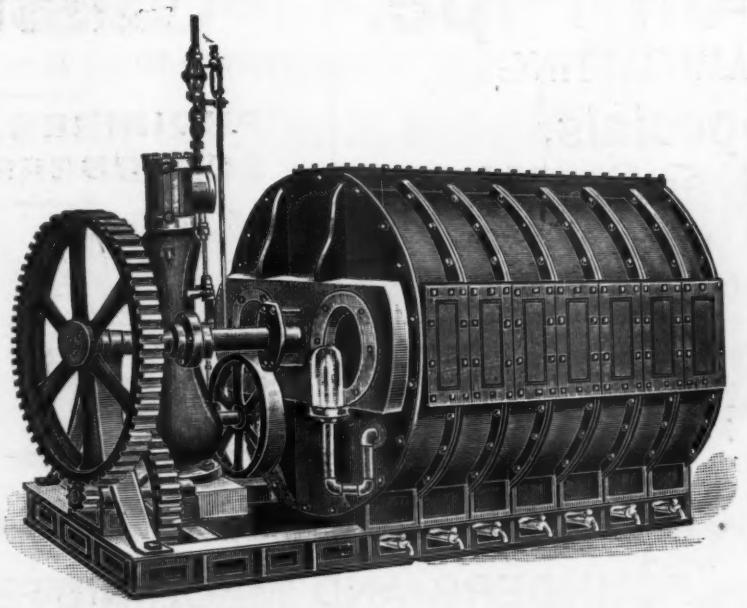

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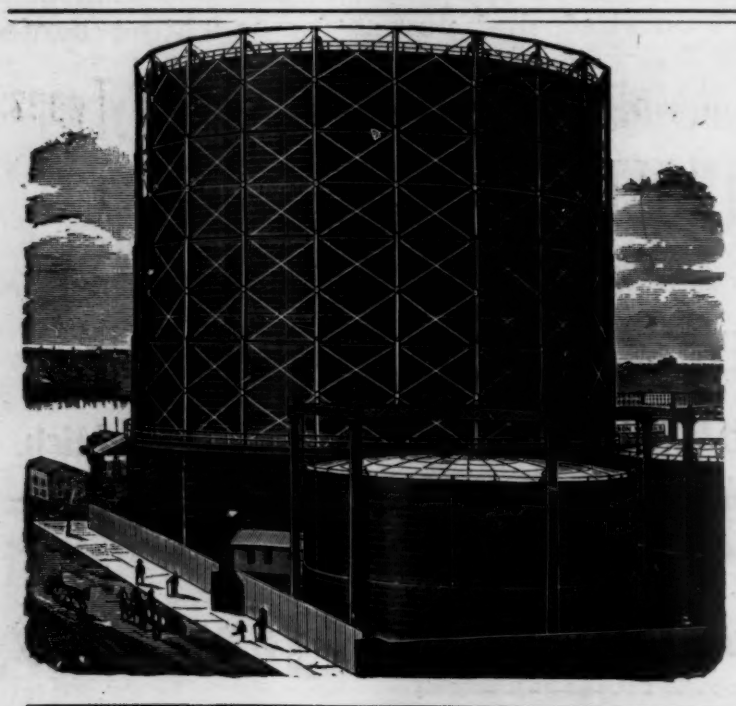

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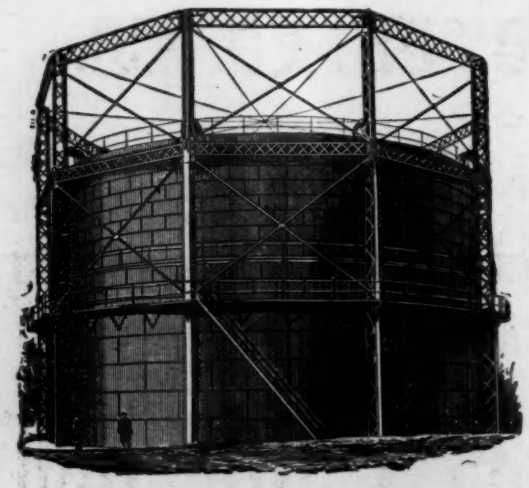

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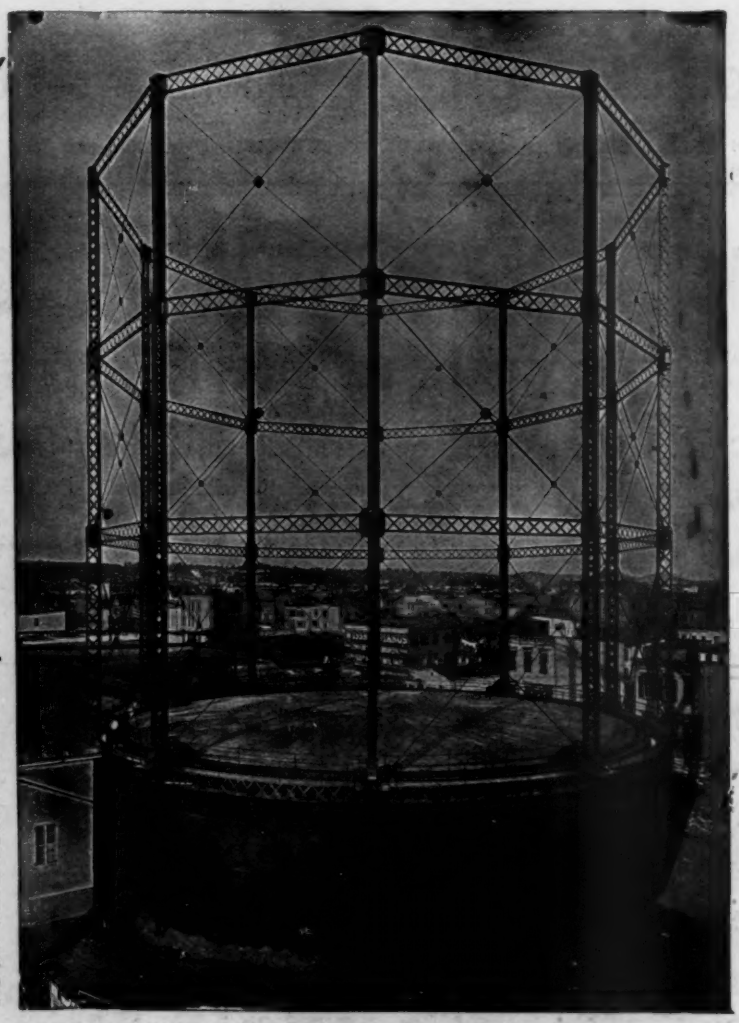

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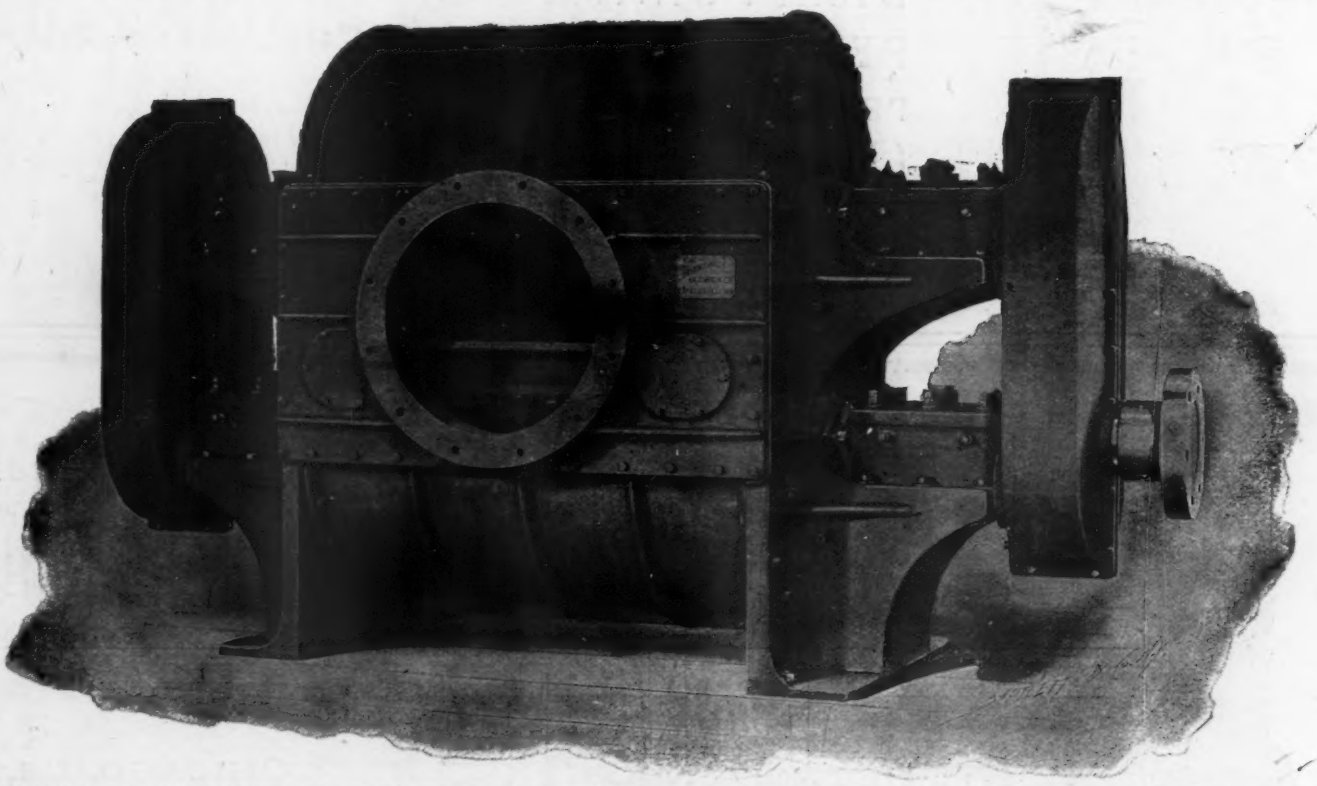

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